VOL. LXXIX. No. 2024. [All Rights Reserved.] SEPTEMBER 8, 1916. [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage.] PRICE FOURPENCE.

LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C. SUBSCRIPTION per annum, Postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. ($5.80); to all other countries, 26s.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, CAN.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, Librairie Etrangère, 22, Rue de la Banque.
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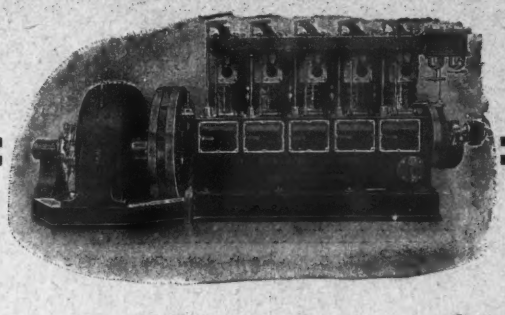

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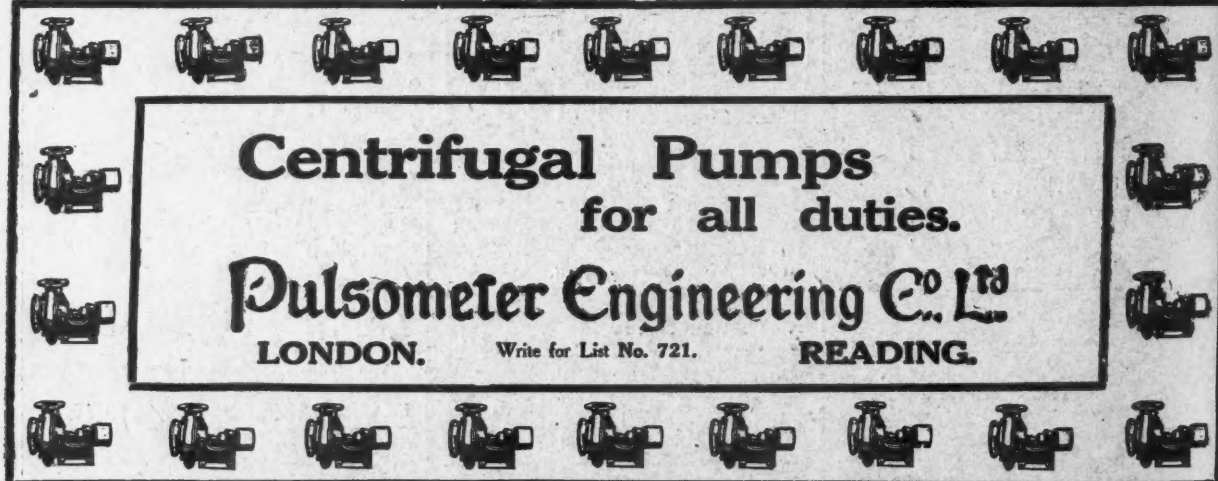

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THE
ELECTRICAL REVIEW.

VOL. LXXIX. SEPTEMBER 8, 1916. No. 2,024.

ELECTRICAL REVIEW.

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Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

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(J. A. Berly's).

1916 EDITION.

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LABOUR PROBLEMS.

THE Trade Union Congress, which opened at Birmingham on Monday last, has had to consider problems which render the meeting perhaps the most important of its kind that has ever been held. The industrial organisation of this country, the relations between Capital and Labour, the very constitution of Labour itself, are in the melting-pot, and into what forms they will be moulded when peace returns we cannot tell. That there will be fundamental changes in all these factors of the industrial situation is so obvious as to have become a platitude; we earnestly hope that they will be so ordered as to establish our industries on new and firmer foundations, having for a basis the cordial co-operation of all parties for the promotion of the national welfare.

Before the war the attitude of the Trade Unions towards society in general gave many the impression that Labour looked, and in time of emergency would look, solely to its own interests, and would seek peace at any price. But, happily for the nation and the Empire, the workers proved true to their race, and manfully shouldered the burdens which press so heavily upon them; the charges brought against them of want of patriotism have been gloriously refuted on the field of battle and in the workshops at home. With their support assured, the outcome of the war is not open to question.

But the war must come to an end, and the new conditions which will then obtain demand the most careful attention and the utmost foresight on the part of the Government, the employers, and the Labour leaders. We are glad to note that in his presidential address to the Congress Mr. H. Gosling emphasises the importance of immediate preparation to meet the needs of the situation, in order to avoid the catastrophe which would result from the discharge of millions of men from both military and civil employment without adequate provision for the resumption of their normal occupations. That the process will be made as smooth and gradual as possible goes without saying, but nevertheless the strain will be severe—and it may come sooner than we expect. It will make the heaviest demands upon the patience and forbearance of the men and women thus set free, and we welcome the spirit in which Mr. Gosling invites the Trade Unions to grapple with the problems that will arise. He strikes the right note when he appeals for the cessation of industrial strife, and the cultivation of a new spirit of conciliation and harmony between employers and employed. There have been faults on both sides in the past; the eyes of the nation have been opened as never before to the folly and wastefulness of antagonism between Capital and Labour, which are mutually indispensable and inseparable, and the two parties have been brought into the most intimate contact, and have learnt to appreciate each the good points in the other. The time is favourable to a real and lasting *rapprochement* between them, and the policy which has been adopted by the Government of allying the forces of the State with the efforts of industry, to shut out unfair competition and to increase production, will go far to enable the crisis to be safely passed and our industries re-established on a durable foundation. Employers will realise that high wages and a high standard of living are not incompatible with commercial success; workers will have learnt, as their leaders have

already done, that restriction of output is contrary to their own and the public welfare, and they will give a fair day's work for a fair day's pay. Great strides have been made towards the realisation of a higher standard of comfort in the workshops, and more salutary conditions of working, which result in improved efficiency, and the spirit of enterprise and progress has been revivified. We look forward to the future with confidence renewed, trusting in the maintenance of the new ideas and feelings which have been called into being by the fierce discipline of war.

The Financing of Russian Industries.

A development of the German practice in the matter of investment or financial trusts is reported as being projected in Russia for the electrical and mechanical engineering industries in that country. Although emanating from a German source, the report is nevertheless of interest in Great Britain, and is of too circumstantial a character to be entirely ignored. We learn, for instance, that the International Commercial Bank, of Petrograd, the Russo-Asiatic Bank, and the Russian Bank for Foreign Trade, together with the banking firms of Rjabuschinski and Meyer & Co., and certain Belgian financial interests, have formed a syndicate and approached the Ministry of Finance for sanction to establish a joint stock bank for the creation and advancement of electricity supply undertakings and mechanical enterprises. The special objects of the bank, which is to have an initial capital of £500,000, soon to be increased to £1,000,000, are stated to relate to the acquisition and utilisation of waterfalls for the production of electrical energy, the grant of short-term credits to electrical and mechanical undertakings, the erection of works for the construction of engines, motor-cars, and aeroplanes, and the conversion into limited companies of undertakings belonging to private individuals. It would seem that although the report refers to erection and construction, the underlying principle is that of financially promoting these objects. The bank also intends to enter into arrangements with the Russian Copper Syndicate Medj for the purpose of ensuring deliveries of copper to the electrical works with which the institution is to be associated. The promotion of works for the manufacture of telephone apparatus and glow lamps is also held in prospect, together with the amalgamation of existing private factories of limited size, and their transformation into companies.

It is well to bear in mind that different Government departments in Russia as a general rule have to express opinions on applications made with a view to securing Government sanction to the formation of joint stock companies. It is asserted that the scheme has met with the disapproval of the Minister of Commerce, who informed the promoters that it was feared that the drawing upon large financial resources for electrical undertakings might easily become a hindrance to the municipalisation of these undertakings, which was authorised by law. In any case, the procuring of private capital for the working of generating stations and tramways must be hindered. It was very much to be regretted, the Minister continued, that the Russian commercial banks were so reserved in the granting of loans of short duration to cities, even in cases where the Government guarantee was given; and it must almost be assumed that this attitude represented the endeavour to oppose the municipalisation of large electrical undertakings. The Minister is, further, reported to have stated that the proposed participation of foreign (Belgian) capital in financial enterprise did not correspond with the repeatedly expressed view of the Government, who wished to reserve to native capital the work of utilising the national resources—in this case, water power.

The Ministry of Finance, on the other hand, is declared to have adopted a non-antagonistic attitude towards the scheme. In any case, a matter of so great moment will be left to the decision of the Ministerial Council, a decision which should be of great international importance.

Rubber.

The outlook in crude rubber is still very disappointing, although the time of year has already been reached when signs of an improving demand usually become perceptible in connection with autumn trade requirements. Preparations in that direction are not unlikely to be put off this year, at least for a time, while the manufacturing trades on both sides of the Atlantic are confronted with so many uncertainties, which must necessarily induce much more caution on the part of consumers. As it is, the latter in many cases appear to hold good stocks due to the fact that their operations have been somewhat checked by apprehensions as to a curtailment of the outlet for their products. The nursing of excessive supplies acquired at higher prices is rather a costly matter under the present stringent monetary conditions, and this feature constitutes an additional disturbing factor, although it is premature to infer that anything like important quantities will come on re-sale. For the present, all indications point to a restriction of the outlet for manufactured rubber, and the policy of buyers of raw rubber is to go slow until the outlook becomes clearer. There is no mistaking the fact that conditions in the United States have grown worse, so that the falling-off in the demand from that quarter is not to be wondered at. Industrial enterprise there, at any rate, has become seriously threatened by the Labour unrest which has lately spread to one of the chief rubber manufacturing districts. In addition to this, there is the railway trouble, although the latest advices suggest that a strike will be averted. America, of course, is by far the biggest rubber consumer, hence, until the Labour difficulties have been straightened out, the outlook is viewed with a certain amount of anxiety by rubber holders. The demand recently was not really bad, in fact considerable quantities of the product were taken care of, while the squaring-up on contracts by dealers in the course of August had a temporary steadying effect.

The statistical position is now impaired by accumulations, and this is no doubt calculated to encourage buyers in their reserve, arrivals having assumed rather larger proportions, and it is probable that spot delivery will remain at a discount, while the estates are still reluctant to make concessions for forward contracts, an attitude which is rather puzzling having regard to the changed conditions, inasmuch as there is not much chance of improvement for some time, at any rate. Much, of course, depends on the turn of events in the trans-Atlantic trade, and in the meantime the market must be expected to be put to a somewhat severe test, since unsold supplies coming to this side will have to be financed, which tends to aggravate the want of confidence. The Straits shipments for July were particularly heavy, representing well over 5,000 tons, this making the aggregate from that source over the seven months 28,718 tons, compared with 17,933 tons in 1915, and 10,090 tons in 1914. At this time last year the prices of both plantation No. 1 latex and fine hard Para were practically on the same level, near 2s. 5d. per lb., but whereas the former now stands at well under that figure, the value of hard Para is not much under 3s. per lb., though the quantities of the latter at present dealt in are of no special importance.

INQUIRIES FOR CABLE ACCESSORIES.

By "S. G."

The above subject is one on which, up to the present, very little, if anything, has appeared in the electrical Press.

During the past ten years or so, this particular branch of electrical work has developed very considerably, and as each year goes by, the users of cable accessories are more particular regarding the design of them.

In view of this, it is but reasonable that engineers should be expected to make their inquiries as clear and as concise as possible.

At present a great number of inquiries are sent to manufacturers, giving insufficient information for them to quote upon.

Very often exceptionally low prices are quoted, "without going into the matter very far," merely to get the order "which may be pending" for cable.

When low prices are quoted in this manner, it is only natural that repeat orders will be given to the same firm. Of course, if there is no cable ordered at the same time, the boxes have to be supplied at a loss.

In order to prevent delay in answering inquiries, due to their not being clear, small sketches or diagrams of connections (as here illustrated) should accompany them, together with a few notes stating definitely what is required, and under what conditions (if special) the boxes are required to work. Not only will the manufacturer thus be treated fairly, but the client will stand a better chance of getting the quotation promptly and correctly.

If some of the following suggestions were embodied in inquiries, I feel sure many manufacturers would appreciate them very much indeed :—

The voltage should always be stated, especially if for H.T. or E.H.T. work.

The name of the cable manufacturer should be stated, especially if the boxes are required for existing cable.

Full particulars of the cable should be given.

State if the boxes are ordinary "joint" boxes, or if disconnecting ; in the latter case, state if fuses or links are required ; also state which cables are to be disconnected.

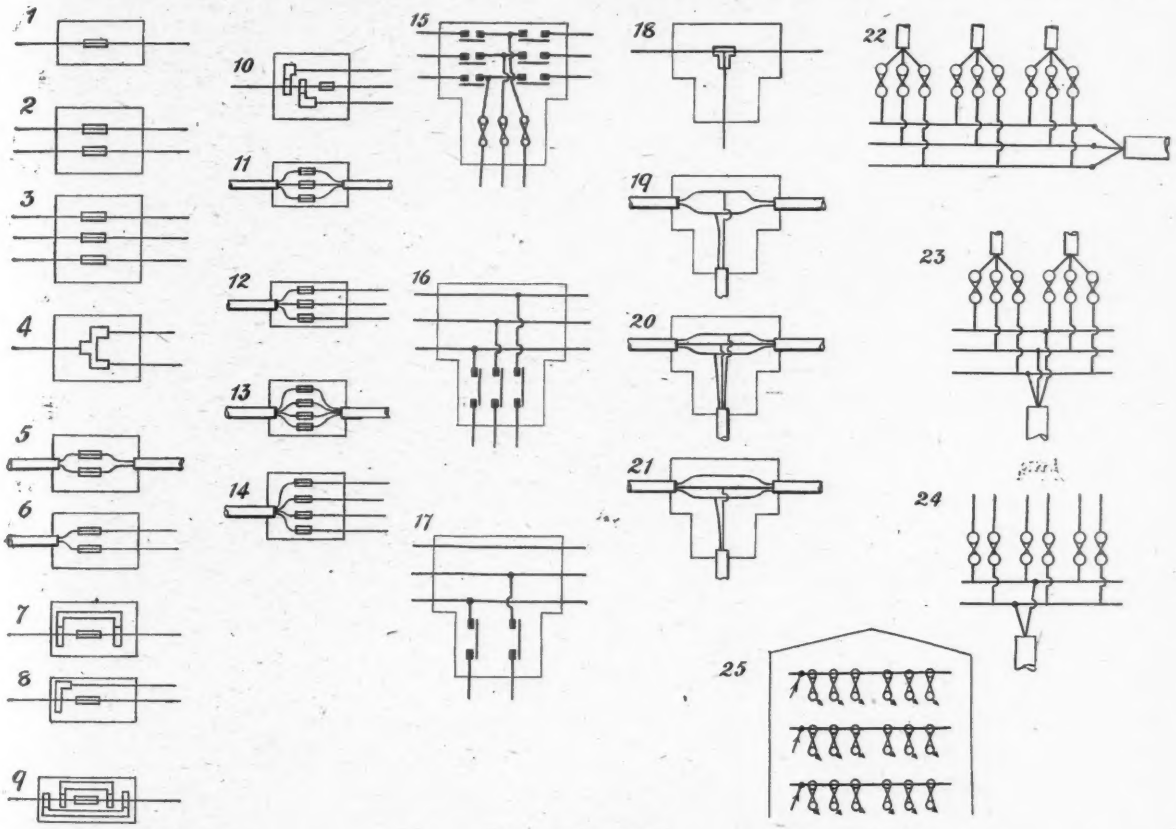
Show links thus $\frac{|}{|}$, and fuses thus $\frac{8}{8}$.

The "lid joint" of disconnecting-boxes is a very important thing, and if any special joint is required, such as "packed joint," "diving bell," or "machine joint," &c., it should be stated.

If the boxes are required for fixing to the wall (and if they are not ordinary "terminal boxes"), it is necessary to give a sketch showing the various cables in each gland ; that is, supposing the cables are different in size or type. If the box is "three-way," it is necessary to know if the cable on the "tee" leaves at the top or at the bottom ; if a "straight through," it is necessary to know if it is to be fixed vertically or horizontally. Inquiries should always state whether compound is required or not.

Sometimes cables are required to be taken out of boxes through pipes, in which case the inquiry should state definitely the size, and whether "conduit" or "ordinary gas pipe."

In connection with "wall terminal boxes," very often bare leads are taken off ; this point should be specially mentioned.



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No. 1.—Straight-through non-disconnecting "single." No. 2.—Straight-through non-disconnecting "2 singles." No. 3.—Straight-through non-disconnecting "3 singles." No. 4.—Straight-through non-disconnecting "two singles off single." No. 5.—Straight-through non-disconnecting "twin." No. 6.—Straight-through non-disconnecting "2 singles off twin." No. 7.—Straight-through non-disconnecting "concentric." No. 8.—Straight-through non-disconnecting "two singles off concentric." No. 9.—Straight-through non-disconnecting "triple-concentric." No. 10.—Straight-through non-disconnecting "3 singles off triple-concentric." No. 11.—Straight-through non-disconnecting "3-core." No. 12.—Straight-through non-disconnecting "3 singles off 3-core." No. 13.—Straight-through non-disconnecting "4-core." No. 14.—Straight-through non-disconnecting "4 singles off 4-core." No. 15.—Three-way disconnecting "3 singles all ways, links on main, fuses on branch." No. 16.—Three-way disconnecting "three singles all ways, links on branch only." No. 17.—Three-way disconnecting "3 singles main (3-wire work) links on positive and neutral." No. 18.—Three-way non-disconnecting "single all ways." No. 19.—Three-way non-disconnecting "twin all ways." No. 20.—Three-way non-disconnecting "3-core all ways." No. 21.—Three-way non-disconnecting "3-core main, twin branch." No. 22.—Distribution box "3-way 3-phase" (fused). No. 23.—Distribution box "2-way 3-phase" (fused). No. 24.—Distribution box "3-way 2-wire" (fused).—No. 25.—Three-phase pillar "six-way" (fused).

When boxes are required to be fitted with troughing sockets, full dimensions of the troughing in use should be given.

If wiping glands are specially required, this point should be mentioned.

If boxes are required to be "watertight," special mention should be made, and if the customer has any preference, he should state what particular joint he prefers—*e.g.*, "machined joint," "packed joint," &c.

In the case of "distribution-boxes," it is necessary in almost all instances to send a sketch or diagram of connections.

Customers should bear in mind that manufacturers are not always in a position to supply exactly what is required, and they should give them an opportunity of quoting for standard material or for boxes the patterns of which are already made.

Where boxes are required for "mining work," it should be specially stated whether they are required for "underground" use or otherwise. This is very important, as unless it is specially stated, quotations are sent in for boxes suitable for "underground use."

Cable manufacturers, as a rule, manufacture several "classes" or "ranges" of boxes to meet all requirements, and inquiries should state whether a cheap, medium, or very good and serviceable box is required. Some boxes are only required for temporary use, and it cannot be expected that the customer would wish to pay, say, £10 for a box when one at, say, £5 would meet his requirements.

It should be stated whether the cable is armoured, and if "tape," or "single," or "double-wire" armoured (even in the inquiry stage it occurs that full dimensions of the cable are necessary).

Drawings sent for approval are not always treated properly. Instances have occurred where material has been made to approved drawings, but when received has been complained about or rejected (very unfair to the manufacturer).

ELECTRIC TRAVELLING CRANES FOR N.S.W. GOVERNMENT.

Thanks to the courtesy of Messrs. Cowans, Sheldon & Co., Ltd., of Carlisle, we are enabled to illustrate one of six large electric travelling cranes recently made by them for the New South Wales Government, all of which have been constructed according to the complete design provided by the purchasers.

The cranes are capable of dealing with loads up to 15 tons at a fixed radius of 55 ft., and the height to the centre of the jib head pulley is 84 ft. above rail. The revolving superstructure is mounted on a high carriage, so as to give a clearance under the jib of 47 ft. at 14 ft. 11 in. from the centre of the crane.

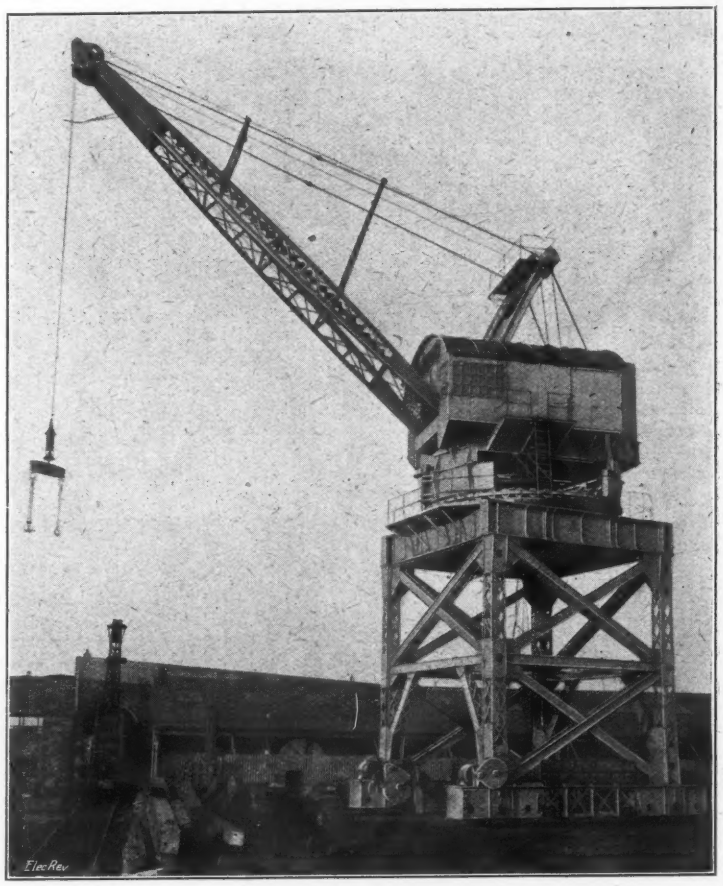
The carriage is arranged to travel on rails laid at 22 ft. 6 in. centres, and has an opening between the rails to allow railway traffic to pass under the crane. The lifting barrels, of which there are two, are driven through two double reductions of spur gearing by two 100-B.H.P. motors, giving a lifting speed with full load of 100 ft. per minute, or, if driven by one motor only, of 50 ft. per minute.

Automatic mechanical brakes of the Weston type and automatic solenoid brakes are fitted on the second motion and armature extension shafts.

The slueing motion is driven by a 25-B.H.P. motor, which gives a speed of 300 ft. per minute at the hook.

The crane is mounted on four pairs of cast-steel rail wheels, one pair of which on each track is driven by a 25-B.H.P. motor through spur gearing arranged to give a speed of 100 ft. per minute.

Each set of control gear is of the contactor type, the contactors being mounted on iron frames suitably fixed at the back of the machinery house, and operated by master controllers situated at the driver's position in front of the house.



Electric Travelling Crane for Coal Shipping.

The whole of the switchgear, including the circuit breakers, ammeter, voltmeter, and connections, is of the ironclad type, mounted on a steel frame, and the complete equipment is arranged to work on direct current at 600 volts. Ample provision has also been made for lighting the crane throughout.

These cranes are for use on the new wharf at Newcastle, N.S.W., for coal-shipping purposes; Australian papers report that tests on the spot showed the anticipated speeds to have been considerably exceeded.

THE SPERRY SEARCHLIGHT.*

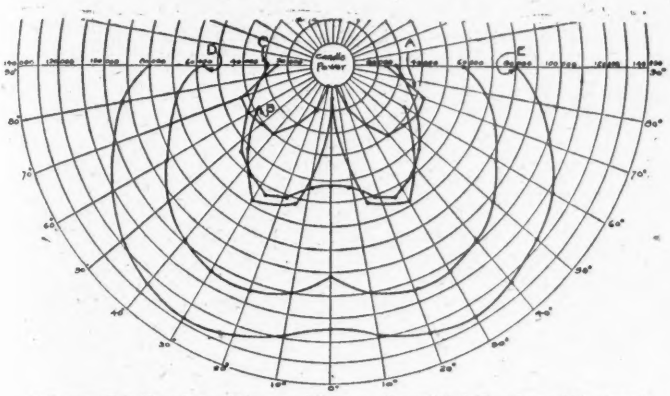
(*Abstract of article by* Capt. Adelno Gibson.)

The one important essential of the projector searchlight lies in the arc source of light, and it has only been recently that any great advancement has been made in this direction. This improvement in the output of the searchlight of a given size lies in the increase of the specific brightness of the light source, which is the brightness per unit area of the light source. It is this tremendous increase of the light source brightness that makes the Sperry lamps so much more powerful than any of the lamps used in the present standard Army and Navy searchlights.

The pure carbon crater has a fairly constant brilliancy of

* Journal of the U.S. Artillery.

approximately 150 c.p. per sq. mm., and it has been considered that this was the highest attainable brilliancy. It is true that this old standard searchlight arc gives the highest brilliancy obtainable from a heat radiating solid, since carbon has the highest melting point of any known element, but this brilliancy has been surpassed in the Sperry arc by making use, in addition to this heated crater surface, of a superheated vapour or gas produced in the arc. This superheated gas is formed from certain special materials that are powerful light producers and with which the positive carbon is impregnated.



A, Present U.S. Navy lamp, 36-in. searchlight. B, Present U.S. Navy lamp, 60-in. search light. C, Sperry lamp, 30-in. searchlight. D, Sperry lamp, 36-in. searchlight. E, Sperry lamp, 60-in. searchlight.

Fig. 1.—Candle-Power Distribution Curves.

For the successful use of this bright vapour as a searchlight source, it is necessary that it be concentrated in a very small area. This is accomplished in the Sperry arc by maintaining a very deep crater in the positive carbon and into which crater this bright vapour is kept pressed. This vapour causes the mouth of the crater to emit a very intense illumination running even as high as 500 c.p. per sq. mm. or 320,000 c.p. per sq. in. The force used to keep the vapour pressed back into the crater of the positive is the arc flame from the negative carbon, and is similar to the arc flame used in the old standard searchlight lamps. The arc flame appears as a flame of considerable velocity emanating from the negative carbon, and gives but very little light in either the old or Sperry type of arc as compared with the positive crater.

The following tabulation of the specific brilliancies in c.p. per sq. mm., which is rightly taken as the basis of efficiency-comparison for all arc work, shows the tremendous light intensity of the Sperry arc:—

	c.p. per sq. mm.
1. Ordinary tungsten filament	2.4 to 5.4
2. Ordinary tungsten filament, nitrogen filled	10.0 to 20.0
3. Tungsten at the melting point (3,500 deg. C.)	72.0
4. Arc flame, ordinary white flame arc	7.0 to 20.0
5. Surface of crater "spot," flame arc positive	50.0 to 90.0
6. Crater surface pure carbon average	150.0
7. The Sperry arc being the the c.p. of dense positive vapour in deep crater of a two-flame arc, special projector electrode	500.0
8. Sun at 30 deg. elevation	775.0

The very high light intensity of the Sperry arc is also indicated by the curves shown in fig. 1. Curve A shows the c.p. distribution of the old type 36-in. searchlight lamp with a maximum of 42,000 c.p. throughout a comparatively small zonal angle, and curve D shows the c.p. distribution of the present Sperry 36-in. searchlight lamp indicating a maximum of 105,000 c.p. with a very wide angle of high intensity.

Another great advantage which the Sperry arc has over the older form lies in the very great reduction in area of the light-giving source or crater.

It is possible by using this new type of arc to concentrate the vapour into a crater having a much smaller mouth area than in the case of a carbon arc of similar amperage, and this results in a reduced angle spread of the beam which is much more nearly parallel throughout its length. For the standard 150-amp. arc the positive carbon is only $\frac{5}{8}$ in. dia., and the crater diameter somewhat less. The negative carbon diameter is only 7/16 in., and with its small holder casts very much less shadow on the centre of the mirror, thus adding more reflected light to the beam.

The principle upon which satisfactory operation of this high intensity arc depends is entirely different from what had been previously supposed. It was first believed that current density was the principal factor for the operation of such arcs, but we have found out experimentally by current densities ranging from 100 to 1,000 amp. per sq. mm. that current density is not the controlling factor, but that current value is the important factor.

It is evident that to obtain this highly concentrated light source and at the same time produce constantly a sufficient supply of bright vapour to fill the positive crater, a rapid consumption of the positive electrode is necessary. It is for this reason that the positive carbons are so much longer than those previously used, being 44 in. for the standard 150-amp. arc. In the old type searchlight arc rapid consumption of the positive was not necessary since the gaseous products were not used at all in the production of light, but in the Sperry type of arc this rapid burning of the positive is necessary to provide the light emitting gaseous materials.

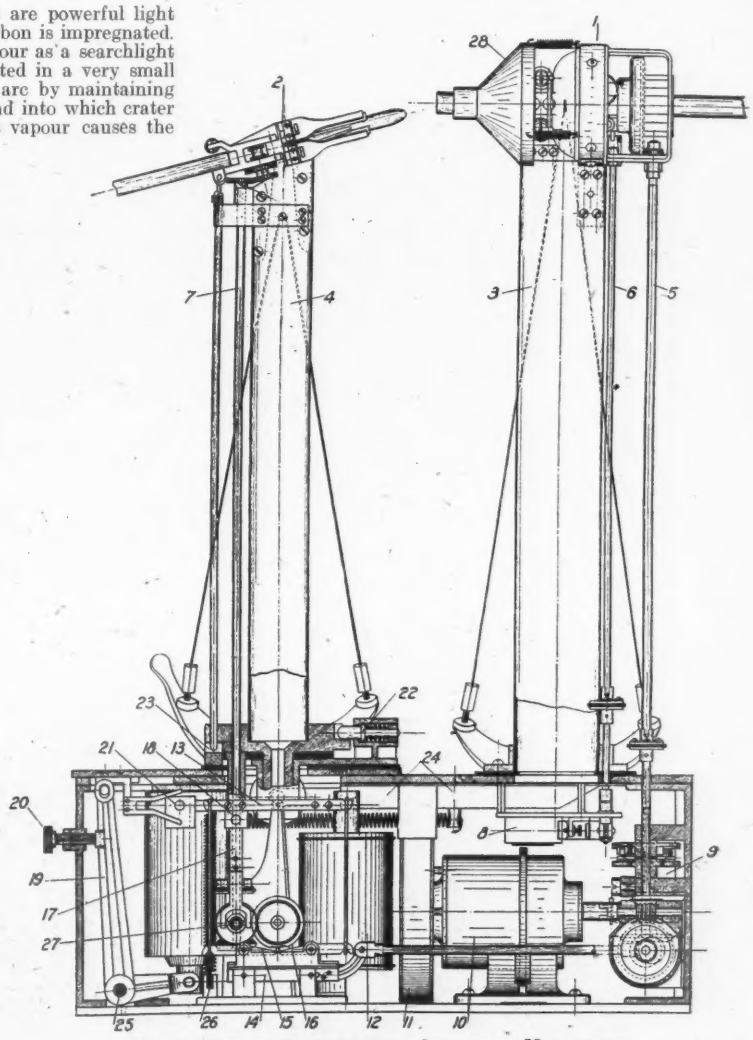


Fig. 2.—Sperry Searchlight: Operating Mechanism.

The Sperry Gyroscope Co., after two years' experimenting with this new form of arc, are now manufacturing projector searchlights giving a c.p. intensity at the arc corresponding to that shown in fig. 1 for the 36-in. size, and which, with an accompanying reduction in the divergence of the beam, gives an illumination on the target of six times that

formerly obtained with the older type searchlight of similar diameter.

Fig. 2 shows an elevation of the Sperry searchlight. The control box contains a shunt-wound motor (10) direct connected to both a centrifugal blower (11) and a gear train for the feeding and rotating mechanism. The blower furnishes air through passages (3) and (4) to the positive and negative carbon holders respectively. The air supplied to the positive holder is forced between a number of heat radiating disks which surround the end of the holder nearest the arc. The cap (28) is open on the upper side to allow the air to escape from the positive holder. This method cools the positive carbon and also removes the heat from the mechanism of the positive carbon holder, received mostly by direct radiation from the arc.

The positive carbon is rotated, being connected to the motor (10) through a vertical shaft (5) and a worm gear. A small crank carrying a crown gear, which engages a gear on the vertical shaft, is used to rotate the carbon by hand if necessary.

The positive feed is operated by thermostatic control of the solenoids (8) through the vertical shaft (6). The thermostat is mounted on the drum, and so arranged that when the positive carbon burns out of the focal point of the mirror the light from its crater is brought on to the thermostat, causing feed of the positive carbon until the focal point is again reached. This automatic control of the positive carbon is also supplemented by hand control.

The feed of the negative carbon is controlled by the solenoid (12) connected directly across the arc, and moves the carbon in the proper direction as the voltage rises or falls. The automatic feed of the negative carbon is also supplemented by hand control. A striking solenoid (21) moves the entire negative holder back the proper arc length on striking the arc.

The entire negative carriage can be turned to the right to permit new negative carbons to be inserted; when so turned, the grip on the carbon is released slightly, permitting a new carbon to be slipped in easily.

The operation of the Sperry lamp is very steady and requires but very little attention after the simple adjustments for length of the arc, speed of rotation of the positive carbon, and the feeding of the carbons have been made. The positive carbon is inserted into the holder by slowly rotating it and pushing it forward at the same time. The negative carbon can be easily put into place when the carriage is swung to one side.

A rheostat is used in series with the arc adjusted, so as to get a voltage across the arc of about 75 volts.

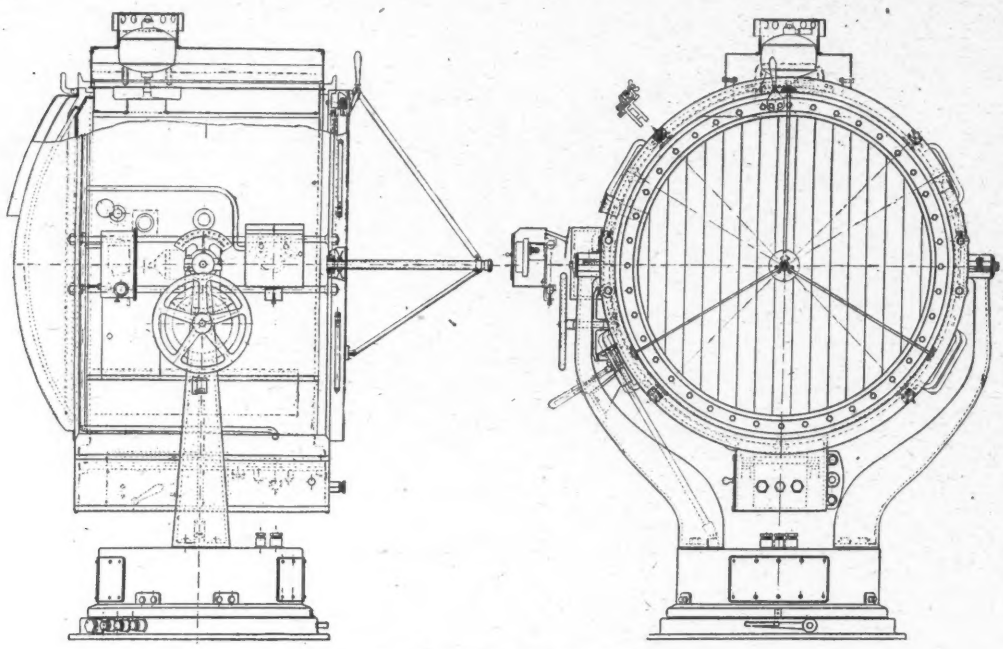


Fig. 3.—Exterior Views, Sperry Searchlight.

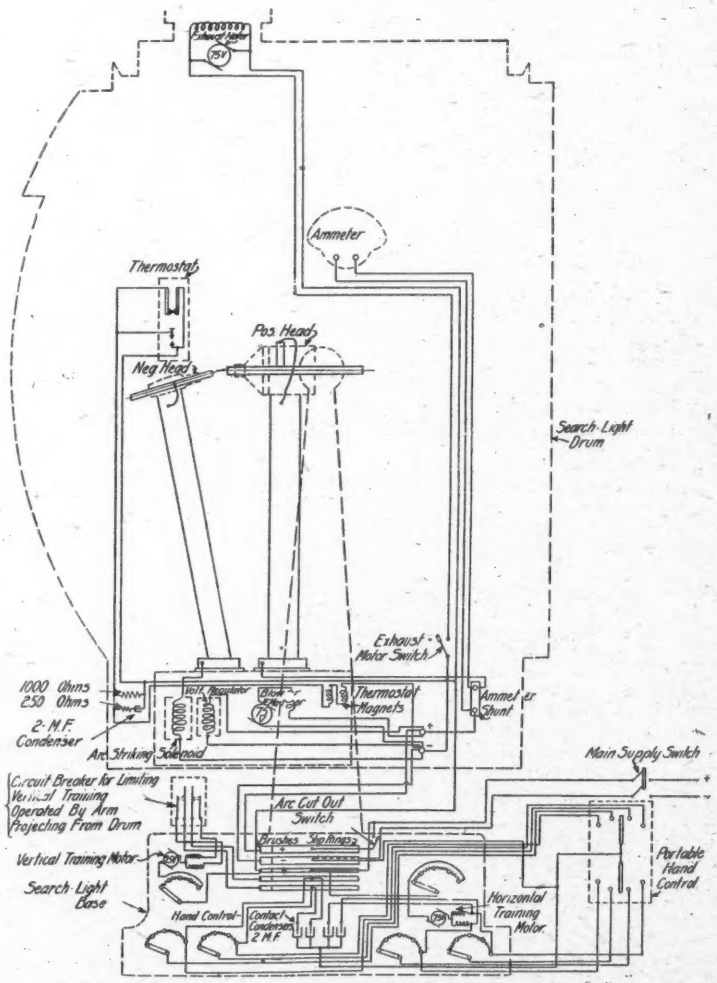


Fig. 4.—Circuit Diagram, Sperry Searchlight.

The hand control is shown in fig. 4. This mechanism consists of a small pointer with a handle 6 in. in length mounted above the operating mechanism, which is contained

in a small brass composition box with overall dimensions of about 3 in. wide by 3 in. high and 5 in. long, and a total weight of about 7 lb.

In operation of the hand controller, the pointer is kept in the direction to which the beam of the searchlight is to be trained. The vertical and the horizontal training motors are series wound, and both have the same system of speed control. By means of a double contact arrangement, two speeds are provided for each motor. On the first, or slow-speed contact, resistance is placed in series with the motor armature; on the second, or high-speed contact, all the resistance is cut out. The second or high-speed is about three times the first or slow-speed.

This controller is connected by an interior communication cable to the operating mechanism at the base of the searchlight, by means of which the drum is turned in azimuth or elevated or depressed, corresponding to the movement of the controller handle at the distant station.

A very important advance in this work has been in the manufacture in this country of carbons suitable for such searchlight arcs. Formerly the only source of supply of carbons suitable for these results was Germany, but after many months of co-operative work between the largest carbon manufacturers of this country and the Sperry Co., the latter is now able to manufacture superior carbons for this purpose.

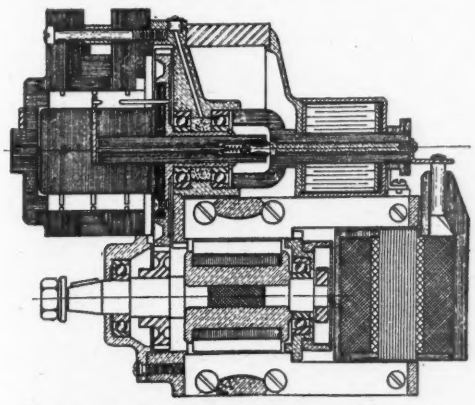
The Sperry Gyroscope Co., which has developed this arc, is now using it in searchlights of 24-, 30-, 36-, and 60-in. dia. In addition, the Sperry lamps are being installed in old searchlights, replacing the old form of arc.

THE BERKSHIRE IGNITION MAGNETO.

At a time when a good deal of attention is being devoted in the United Kingdom to the question of ignition magneto manufacture, to remove the dependency on German-made machines of the British motor-car industry which existed prior to the war, considerable interest attaches to any new design of magneto that may be introduced, especially when such new design embodies novel features, as is the case with the "Berkshire" machine, which has recently been brought out by the Berkshire Magneto Co., of Pittsfield, Mass., U.S.A.

One of the principal claims made for this new magneto is that, while it gives a strong spark at low speeds, and thus ensures easy starting of the engine to which it is attached, the power of the discharge increases at a lesser rate than the speed. It is, of course, possible to have too hot an ignition spark; if the high-speed discharge is very intense, it has a destructive action on the points of the sparking plugs and the contact breaker, and puts an undue strain on the condenser and the insulation.

Owing to the peculiar magnetic circuit of the machine under notice, it is claimed that the discharge current reaches

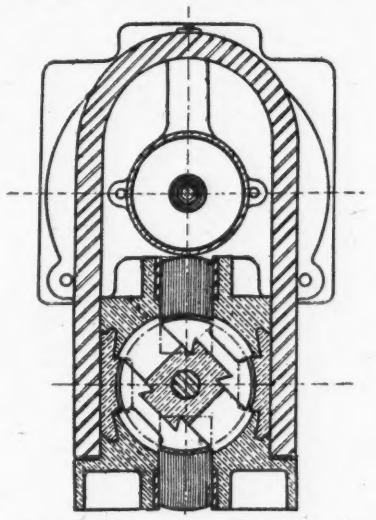


Section of Berkshire 12-cylinder Magneto.

one half of its maximum amount at a speed of 50 r.p.m., while at 150 r.p.m. it has attained 80 per cent. of the maximum intensity. This means that the spark produced at 150 r.p.m. is practically identical with the spark at 3,000 r.p.m.

Another feature of the machine is that there are no windings, either low or high-tension, on the armature. In fact, the only rotating member which carries electric current is the internal portion of the distributor. The horse-shoe magnet has two poles, while two supplementary poles of soft iron are placed in the mouth of the horse-shoe, these being magnetically insulated by aluminium. In the accompanying transverse sectional drawing of the magneto, it will be seen that there are four deep grooves in the armature. By this arrangement the four iron portions of the armature are made to correspond to the pair of main poles and the pair of supplementary poles in the field magnet. The iron parts of the armature are held together, and also magnetically insulated, by aluminium, the driving shaft and the armature pole pieces being locked together by a die-casting process.

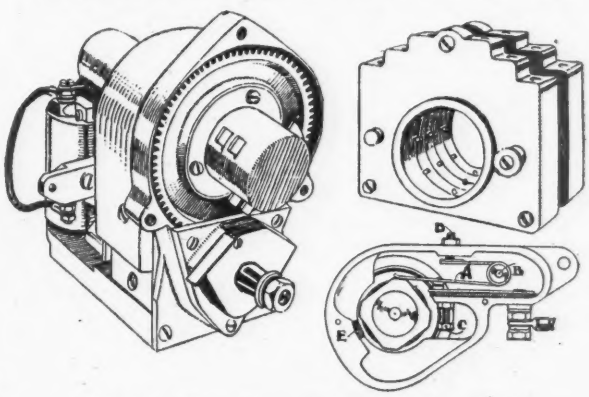
The supplementary pole pieces, which are made of soft-iron laminations, are also die-cast in their aluminium cases, and it will be seen from the lengthwise sectional drawing that the laminations extend a good distance behind the horse-shoe. It is between the ends of these projecting supplementary pole pieces that the coil unit is placed; this consists of a soft-iron core, having a L.T. and a H.T. winding; there is thus a magnetic circuit from one of the supplementary pole pieces through the core of the coil and back *via* the other supplementary pole piece. When the armature is in the corresponding position, the magnetic circuit passes from one main pole through a segment of the armature to one of the secondary poles, thence through the core of the coil unit, and back *via* the second supplementary pole piece, opposite armature segment and other main pole. It is now possible to explain the condenser effect of this circuit. When



Section of Magneto showing Unwound Armature Construction.

the armature is rotating, the passing of the iron portion across the faces of the pole pieces sends a series of magnetic "charges" into the projecting portions of the supplementary poles. Through the air surrounding the latter, a certain amount of magnetic leakage can take place, so that the upper and lower supplementary poles may be regarded as the inner and outer coating of the condenser. The air gap provides a constant leak or discharge resistance, so that the flux which passes through the core of the coil unit cannot be increased above a certain point.

From the sectional drawings, it will be observed that a condenser is contained in a small round case mounted on top of the upper supplementary pole piece; thence the H.T. current passes to the central member of the distributor which



Details of Contact-breaker and H.T. Distributor.

carries a number of brass segments corresponding to the number of cylinders of the engine. In the outer part of the distributor are brass pins; between the pins and the rotating sectors, however, there is no actual contact, the current jumping across a very small air gap; the safety gap is contained within the distributor.

Turning to some of the mechanical details of the machine, the contact-breaker mechanism is interesting, the method of adjustment being on novel lines. The spring A is one continuous piece of steel, wrapping round the pin B, means of adjustment being provided at the points C and D. The lower, insulated, platinum point is carried on a small strip of spring steel backed by a stout strip of red fibre. The upper screw D adjusts the tension of the contact-breaker spring, and the lower screw controls the position of the contact-breaker

points. The whole contact-breaker mechanism is so arranged that it can be easily removed for cleaning or adjustment purposes, while the coil unit can be withdrawn by removing a couple of screws.

The range of "Berkshire" magnetos includes a two-spark pattern for four and six-cylinder engines, and four-spark models for four, six, eight, and 12-cylinder motors. The construction is claimed to be particularly well adapted to the four-spark system, the machine, of course, then running at half the speed of the two-spark type. The makers point out that another advantage of the four-spark system is that it provides a six-cylinder magneto with a very wide range of adjustment, 45 deg. being easily obtainable, this being 45 deg. on the crankshaft. This wide range, coupled with the automatic limitation of spark intensity, gives, it is claimed, all the advantages of battery systems of ignition at low speed and of wound-armature magnetos at high speeds, with a practical elimination of the ordinary disadvantages of both.

Finally, it may be mentioned that the new machines are characterised by light weight and strong mechanical details, and that, electrically and mechanically, they are excellent manufacturing propositions. The solid, unwound armature, for example, can be made a close fit within the magnet poles without any difficulty; the coil unit is easy to wind, and nearly all the non-magnetic parts readily lend themselves to production by die-casting.

OIL ENGINES AND STEAM ENGINES IN COMBINATION.

(Abstract of Paper read before the DIESEL ENGINE USERS' ASSOCIATION *by* GEOFFREY PORTER.)

MY object is to discuss some of the problems met with in extending a comparatively inefficient generating station of the "lighting load" order with a plant capacity round about 1,500 KW., and equipped with steam engines, some with condensers and some without; there are dozens of such stations dotted about the country, from 12 to 20 years old.

Some five or six years ago, several papers were read, in which were discussed the advantages to be gained by the use of the Diesel engine. Some of the writers, I think, rather overstated their claims, and all conclusions were based chiefly on results obtained on the Continent with plant manufactured by Continental firms.

Now, however, the Diesel engine is making good headway; manufacturers and users have gained experience; the fuel oil question is in a fair way to being solved by utilising the products of the distillation of coal; and though the capital cost is, and will probably continue to be, high, the essence of the problem, *i.e.*, the balance in hand to credit of net revenue account in the annual balance-sheet, is found to improve in proportion to the use of the Diesel engine. The mixed stations have justified the wisdom of their engineers during the present extremely difficult times; but for their efficient oil engines many of them would be in a bankrupt condition to-day.

The capital expenditure on three specified stations up to the time when Diesel engines were put down, was (for generating plant only) as follows, viz. :—

Station "A," £29·1 per KW.; Station "B," £28·0 per KW.; Station "C," £39·8 per KW.

Stations "A" and "C" condense the exhaust steam; Station "B" is a non-condensing station. The overall thermal efficiency of the three steam plants in the year prior to the adoption of Diesel engines was :—Station "A," 4·93 per cent.; Station "B," 6·1 per cent.; Station "C," 2·6 per cent.

These results are not very encouraging when one considers the money that has been put into the plant in each case. Nevertheless, the figures are typical of stations of their class.

This thermal efficiency is arrived at by calculating the British thermal units equivalent to the units generated at the dynamo terminals (taking 3,412 B.TH.U.'s per B.O.T. unit) and working out the total as a percentage of the B.TH.U.'s in the quantity of coal consumed. The figures given are not absolutely accurate, owing to the heat-values of the coals used not being certain.

As one can speak most fully from one's own experience, I trust I may be forgiven if I analyse the various figures tabulated for Station "A." In 1911, extensions of plant became imperative; what had been done in the past and the possibilities of the future were very carefully considered.

The capital expenditure on generating plant up to the end of the financial year 1910-11 was as under :— .

ENGINE-ROOM PLANT.

Engines, dynamos, and foundations...	£4,690	£15·2 per KW.
Condensing plant and pipework ...	3,506	

BOILER-HOUSE PLANT.

Boilers and their brick settings ... (nominal evaporation, 36,000 lb. per hour)	£3,602	£13·9 per KW.
Feed-pump, injectors, and pipework...	1,500	
Chimney, economiser, and flues ...	2,400	
Gross capital expenditure		£29·1 per KW.

On this outlay the annual charges for interest and redemption of capital amounted approximately to £1,200, or £2·23 per KW. installed.

On the other side of the account, 1 KW. of maximum load on the feeders produced (in 1910-11) 1,243 units, equivalent to about £21. Hence the capital charges on the steam-raising and using plant alone absorbed as much as 10 per cent of the earnings. (Annual load factor, 14·2 per cent.)

After consideration it was decided to extend the plant with Diesel engines. At the time an addition of 250 KW. was required, and it was decided to divide this capacity between two engines: firstly, because a better "running-plant" load factor could be obtained in this way; and, secondly, from motives of caution.

The capital cost of the extension worked out at £16·95 per KW. Two years later a third engine was obtained coupled to a 260-KW. dynamo at a capital cost of £19·27 per KW. In all, the capital expenditure was £18·13 per KW. for 510 KW. capacity.

Station "B" spent £26·7 per KW. for 600 KW.; and Station "C" a sum of £18·66 per KW. for 540 KW. of plant. Local circumstances entailed a very heavy expense for foundations in the case of "B," while plant was more expensive in first cost than at the time when I was in the market. "B" profited by other people's experience in the matter of "accessories," and wisely spent rather more money on them—notably, on fuel oil storage tanks. "C" adopted engines and dynamos which required large foundations, with the result that the gross capital outlay was rather greater than it was in Station "A."

An equivalent steam plant for "A" would have necessitated an outlay of £7,450, equivalent to £14·8 per KW. The annual charges for interest and repayment of principal would have been £177 less for a steam plant than for a Diesel plant.

On a "running plant" load factor of 65 per cent., and with coal of about 13,000 B.TH.U's per lb., I expected to produce 500 units, more or less, to a ton of coal—taking the whole steam plant into consideration. Inquiries in several quarters led me to expect confidently that a Diesel engine, under the same load-factor conditions,

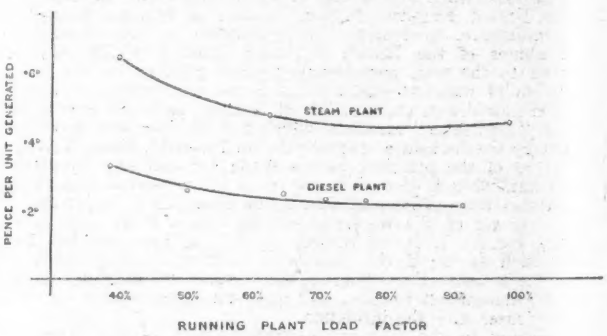


FIG. 1.

would deliver 3,200 units per ton of fuel oil of 17,500 B.TH.U.'s per lb. Assuming a price ratio of 2½ to 1 between oil and coal (as it was approximately for "A" in 1910 to 1911), there was a large margin in the earning capabilities of the two types of plant to cover the difference in the annual charges.

The problem was, however, complicated by the existence of the original steam plant, in conjunction with which the Diesel engines would be required to work. Undoubtedly the boldest course to adopt would have been to write off a part at least of the steam equipment. This plan was considered, but the sum required for the purpose was too great for the finances of the undertaking to bear.

Had more steam plant been added to the old, and allowing for a much shorter loan period and a higher rate of interest, the annual combined capital charges would have amounted to £1·62 per KW. of plant. The earning powers of one KW. were not expected to increase. The total capital cost would have become £22·1 per KW.

The following returns give some important figures for "A" :—

Year.	Revenue per KW. of max. load.	Gross profit per KW. of max. load.	
1910-11	£21·2	£11·3	Steam plant only.
1911-12	20·4	10·4	Part Diesel about 2 months.
1912-13	19·1	11·1	Diesel plant 82·2 % of output.
1913-14	20·0	11·8	" " 80 " "
1914-15	27·3	14·9	" " 91·7 " "
1915-16	23·2	14·1	" " 98 " "

In the first column the revenue per KW. of maximum demand on feeders was artificially increased by the maximum output falling off during the last two periods, owing to restrictions, more rapidly than did the number of units sold. In the second column the figures of gross profit were adversely affected by the steam "stand-by" charges, two boilers being kept up for the greater part of the time in case of Diesel engine failures. During the last two years in the table the boiler house was entirely shut up, except for a month or so. There is no doubt that the efficient working of the Diesel engines effected a marked increase in the gross profit per KW. of maximum demand on the plant. In the year 1912-13 the tendency of the gross profit had begun to counteract the downward trend of the revenue curve.

An examination of the figures quoted shows that the lower cost of operating a Diesel engine plant quickly extinguishes the higher

annual charges for capital, although in the case of "A" the steam plant has an advantage of £·33 per KW. in respect of capital charges.

Five years ago opinions differed as to the functions of a Diesel engine in a "mixed" station. I think it is now the general practice to work the Diesel engines "for all they are worth," and to keep the steam engines in reserve.

A comparison of the generating costs of the three stations before and after adopting Diesel engines is instructive:—"A" shows a reduction of ·358d. per unit generated; "B" shows a reduction of ·046d. per unit generated; "C" shows a reduction of ·276d. per unit generated; these figures being obtained in the face of rising fuel prices. Similarly the overall thermal efficiencies have improved:—"A": Thermal efficiency rose from 4·93 per cent. to 22·6 per cent.; "B": Thermal efficiency rose from 6·1 per cent. to 10·5 per cent.; "C": Thermal efficiency rose from 2·6 per cent. to 6·5 per cent. These figures depend, of course, on the proportion of the units generated by oil as a percentage of the total units generated. "B" having a steam plant of five times the capacity of its oil installation, was obviously unable to make so great a reduction as was "A," where the proportion was, roughly, 1 to 1; and "C," 1·6 to 1. The greatest reductions are in the items fuel, wages and repairs.

The cost of fuel per unit generated for station "A" at various load factors for the steam and oil sections of the plant is shown graphically in fig. 1. Coal costs 18s. 3d. per ton, fuel oil was at 64s. per ton. The figures are taken from the ordinary weekly records, and are the result of every-day running conditions.

From approximately full load down to half load there is a drop of 6·3 per cent. in the steam figures, and over a corresponding series there is one of 20 per cent. in the oil figures.

A statement of some of the "vital statistics" of eight generating stations having both steam and oil plants may be of interest; it shows a general tendency towards improvement in the financial position since the Diesel engine was adopted.

Station.	Reduction in fuel cost per unit sold.	Gross profit per KW. of max. load before oil plant.	Gross profit per KW. max. load after adopting oil plant.
1	·31d.	£11·3	14·1
2	·23d.	9·9	10·5
3	·20d.	8·8	14·3
4	·18d.	11·1	15·2
5	·20d.	3·37	6·9
6	·21d.	8·4	10·2
7	·11d.	9·8	11·5
8	·06d.	13·4	15·1

The Diesel engine has this important advantage over the steam equipment. If valves are leaking and adjustments are not in order, the fact becomes quickly obvious. The indications on the gauges (and there are not many of them) draw one's attention to irregularities.

But a steam engine may run beautifully to the outward eye and ear although piston valves and piston rings may leak, and the valve settings may be wrong owing to eccentric strap wear; the boiler settings may be drawing many cubic feet of air into the flues; the fires may be too thick or too thin. In very many cases, provided the main steam gauge is showing about the correct steam pressure, there is a general feeling of satisfaction with the aspect of affairs.

Personally, I managed to improve the steam costs of "A" by 20 per cent. or so by the aid of flue thermometers, draught gauges, flue gas analysers, and graduated staffs in the boiler-feed water tanks; but even at that the benefit was but a fraction of that gained by purchasing plant that was inherently more efficient from the thermal point of view. Putting the three things together, capital charges, running costs, and gross profits, the advantage accruing from the use of the Diesel engine for installations within the limits indicated in this paper is manifest. The figures quoted for "A" showed the combined annual capital charges for interest and redemption to be £1·95 for a mixed steam and oil plant, and £1·62 for a steam plant only, the difference being one of 20 per cent. Taking the running costs for the last completed financial year, the reduction in running costs from those obtained in pre-oil days was no less than 34·4 per cent.

I should like to urge on all Diesel engine users the great value of the indicator diagram as a quick and ready means of testing the condition of an engine. The "hand-drawn" cards are particularly valuable, as showing the distribution of the fuel oil among the cylinders. If cards are taken and filed for reference and comparison, it is not difficult to keep an engine well up to its test results. The outlay of £10 to £15 on an indicator set is a small matter in comparison with the losses that may occur if an engine is not periodically checked.

The choice of the most suitable Diesel engine to accept, when confronted with a number of them, is not easy.

I do not venture to lay down any rule for the guidance of anyone in this matter, but I will go so far as to say that my own preference is for (1) a low piston speed; (2) a low mean effective pressure from the full-load card; and (3) a low piston and crank-pin loading. The general design of the crankshaft and its bearings, the gudgeon pins, and the lubricating arrangements throughout must, of course, be examined also.

The transition from the paper stage to the practical one of operating the Diesel engine not unnaturally brought to light a number of occurrences with which engineers were not familiar. In course of time it was felt that a central body competent to collect and compile records and to act as a standardising authority to some extent was a necessity. In this way the Diesel Engine Users' Association came into being.

I should like to draw your attention to three subjects which have been of great interest and which are far from being exhausted. The first is the problem of the lubrication of Diesel engines. An endeavour to lay down any definite pronouncement in the matter of how much or how little oil should be used for various engines was found to be impossible. Mr. C. O. Milton, one of our most energetic members, gave us a communication on the subject and contrived to establish some relations between the lubrication of engines and the conditions under which they are used; but even here he lighted upon two series which did not agree and for whose disagreement there did not appear to be any reason. The actual rate of the destruction of lubricating oil in the cylinder of a Diesel engine is a matter which would well repay a careful investigation.

We are at present engaged in investigating the vagaries of air compressors. One feature emerges as being of paramount importance, and that is the behaviour of oil-impregnated vapours under the influence of high pressures and temperatures. I think it is a line of investigation eminently suited to the labours and talents of the National Physical Laboratory.

Last, and perhaps of the greatest importance, is the question of fuel oil supplies.

Our engines will work well on the products of the distillation of coal—British coal—that coal which is used to-day so uneconomically that at the best but 15 per cent. to 20 per cent. of its available energy value is actually utilised. Continental users and manufacturers have used tar oils and tars with the greatest success for many years in their Diesel engines, and we can do so too. The cost of adapting an existing engine for the purpose is not excessive, and, under present conditions, at any rate, such cost will be abundantly repaid.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Electric Cooker in India.

I have only to-day received my copy of the ELECTRICAL REVIEW for May 12th, in which I note that Mr. Meares criticises my statement that it is difficult to keep servants for more than a year in India.

I am afraid in this particular I fell into the error of generalising about India. While I venture to say that my statements are essentially correct as regards Rangoon, I recognise, of course, that in a country which holds so many different races as India the conditions may be very different in other parts. I am glad that Mr. Meares, than whom there is no one better qualified to speak, has found no more serious misstatement in my article.

In Rangoon the majority of the servants are not native to the province. They go there principally from Madras, under the attraction of much higher wages, but usually return to their own country after they have saved a little money.

After nearly a year of housekeeping in Australia, the Memsahib's feelings towards the Indian servants are much kindlier than when amongst them. When we compare this beautiful country and its glorious climate with Rangoon, we wonder why white people willingly exile themselves in India; but when our thoughts turn to our dear old butler, well—India was not so bad.

Charles S. Jeffrey.

Sydney, N.S.W., *July 17th*, 1916.

High Prices.

I should like to utter a protest, and, at the same time, a warning to manufacturers, against the present, apparently unnecessarily, inflated prices of some of the electrical accessories in general use. As a typical example, cord grip holders, which before the war could be bought for 3s. 4d. to 3s. 6d. per dozen, are now fetching anything from 9s. 6d. to 16s. per dozen. I was last week asked the latter price, but, needless to say, did not pass an order.

Now if these articles could be sold before the war at 3s. 4d. per dozen, is there anything either in the advanced cost of materials or labour to justify such an exorbitant charge? I submit that, taking these advances into consideration, the selling price of this line should not be more than 6s. 6d. per dozen.

A traveller recently told me that the high prices ruling were due to the demand alone, there being no outside competition. If this is the case, manufacturers are taking an unfair advantage. But there are a number of neutrals and others already coming into the market, and, if they bring down prices, are we to deal with the manufacturer who has fleeced us, or the neutral who has brought down the inflated charges? As an instance of this, I recently bought an article, stated to be of Japanese origin, at 8s. a gross, but for a similar English article I am asked 20s. The pre-war price was 8s.

In conclusion, may I also protest against "brassed" iron terminal screws being substituted for brass screws, a very common practice nowadays.

C. Culmer Hodges, A.M.I.E.E.

Electricity Works, Dawlish,
August 30th, 1916.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

The Turbine Furnace.

A new type of furnace has been introduced by the Turbine Furnace Co., Ltd., of Caxton House, Westminster, S.W., which is adaptable to all kinds of boilers, and is easily installed. It has been designed, as shown in figs. 1 to 3, on the principle of the impulse turbine, the air trough being compared to the nozzle, and the fire-bars to the blades of the turbine. The air for combustion is forced between the bars, which offer a minimum of resistance, and each firebar receives an equal amount of air, which is distributed through the narrow air spaces in the form of fine sprays. It is claimed that by the design of the air injector an efficient pressure is obtained, the design of the air trough of diminishing section assures an even flow of the air for combustion, and the design of the firebars ensures the highest efficiency of the draught, each air space receiving an equal amount of air under pressure. The fire-bars project forwardly to intercept the air with a minimum of resistance. The air forced through the narrow air spaces is thoroughly diffused throughout the fire. There is perfect contact of air and fuel, and combustion with a minimum of waste gases. The grate consists of from four to six furnaces, each receiving its own air supply. This method, besides ensuring an evenly burning fire, makes it possible to use small steam jets for creating the draught. Special attention has been paid to the velocity and expansion of steam, flow of air, frictional losses, &c., with the result that a maximum of draught is obtained with a minimum of steam. There is no upkeep for moving machinery, nothing to get out of order, and the cost of generating forced draught by this method is said to be much less than by any other system.

Tests have been made on the furnace installed in various works; for instance, at the North Dublin Union, with ordinary bars in a Lancashire boiler, using hard steam coal, the cost of fuel was 28s. per 1,000 gallons of water evaporated; with the turbine furnace, using 2·5 breeze to 1 of slack, the cost was 18s. 1d. per 1,000 gallons, and with coke breeze alone, 13s. 11d., an economy of over 50 per cent. At Rathmines U.D.C. electricity works, a ten-days' test was carried out to compare the turbine furnace fitted to a Lancashire boiler and a mechanical stoker fitted to another boiler of the same size (30 ft. by 8 ft.). The former was able to burn a large proportion of coke breeze, and the cost of fuel per unit generated was reduced from 0·62d. with the ordinary stoker to 0·28d. with the turbine furnace; moreover, a single boiler fitted with the new furnace was able to take the whole load, whereas previously two boilers had been in use.

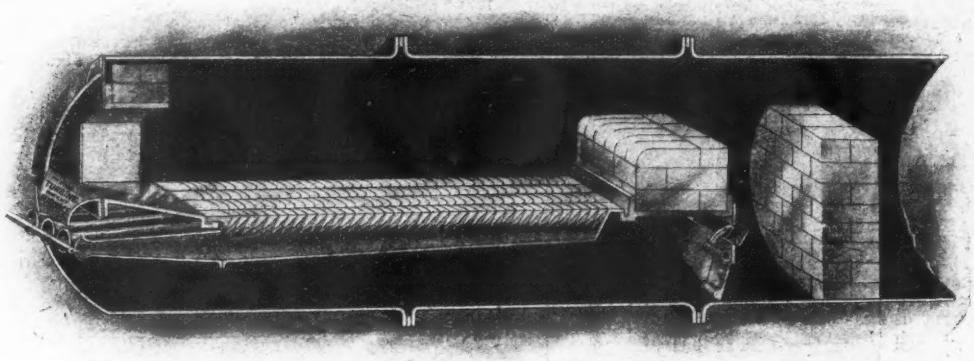
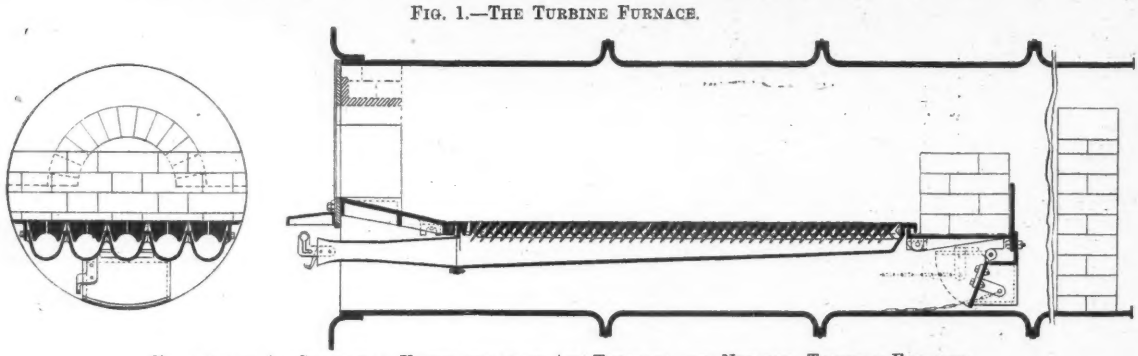


Fig. 1.—The Turbine Furnace.



Figs. 2 and 3.—Sectional Views through Air Troughs and Nozzles, Turbine Furnace.

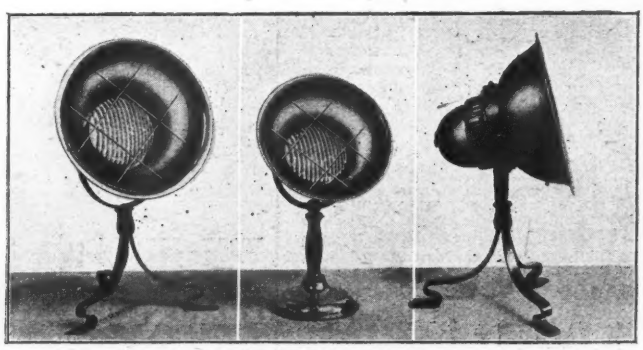


Fig. 4.—The "D.G." Bowl Electric Fire.

Fig. 5.—"D.G." Fire.

D.G. Bowl Fires.

The "D.G." bowl fire, which has been introduced by Messrs. Drake & Gorham, Ltd., of Felix Street, Westminster Bridge Road, S.E., is made in two types, one rated at 1,000 watts, and supported on a three-legged black iron stand, and the other loaded to 750 watts, and mounted upon a black and copper pedestal. Both forms are illustrated in fig. 4, which shows also the larger model turned sideways, so that its construction can the more readily be followed. The heating unit, which is detachable, consists of a dome-shaped piece of special fireclay having vertical ribs on its rounded surface, between which is laid the spiral resistance wire. The element is mounted on a disk of asbestos stone or similar material, the connections to the terminal plate within the domed cover behind being of rigid perforated metal strip. Around the circular element is a bowl reflector of solid copper, accidental contact with the glowing coils being prevented by a light grid of stout wire.

As will be seen from the illustrations, the bowl reflector can be swivelled at any angle between the vertical and horizontal, and will stop in any position, but when turned to the horizontal posi-

tion it is held by a neat spring device, which prevents any possibility of the bowl tilting up and overturning a kettle or other vessel placed on the grid above the elements. Fig. 5 shows the fire with the bowl turned up so as to be available for heating water, or for making toast, the wire grid serving as a support, well away from the glowing coils. The elements, which run at a bright red heat immediately they are switched on, are guaranteed for 12 months, and can be renewed quickly at small cost. No switch is provided, so that so far as the control is concerned, the fire complies with the latest I.E.E. wiring rules for electric heaters. Overall the larger heater, 1,000 watts, measures 19 in. in height, the diameter of its reflector being 10¼ in.; the smaller heater is 17 in. in height, with a 9-in. reflector. The reflectors are of solid copper, and the price is quite moderate.

The J-M Fire Extinguisher.

Messrs. Turners & Manville, Ltd., of Hopetoun House, Lloyd's Avenue, E.C., have sent us particulars of their new fire extinguisher, which, it is claimed, possesses many advantages. In design it is cylindrical, with dished ends, and measures 3 in. in diameter by 12½ in. long. The pump and valves, which are enclosed in a separate container in the interior, deliver air to a compression chamber in the dome of the extinguisher; this arrangement prevents the chemical contents coming into contact with the main working parts, and allows for an even pressure of air in the discharge chamber. The nozzle, which is fitted in the concave base, is protected against accidental fall or damage, and is provided with a lever valve to prevent waste of extinguishing fluid. The pump spindle and leather are removable for examination or renewal.

Thirty full strokes of the pump will provide sufficient air to discharge the whole of the liquid contents in a steady non-pulsating stream to a distance of 30 ft.

The fluid will neither stain nor damage apparatus or fabrics with which it may come in contact; it is non-poisonous, free from moisture, and a non-conductor of electricity.

This extinguisher has been tested on burning petrol, celluloid, calcium carbide, carbon disulphide, and ordinary fires, also on electric arcs under severe conditions in the open, and in each case it has successfully extinguished the fires.

A High-Speed Squirrel-Cage Winding.

In an induction motor-winding patent, No. 1,191,209, issued to the Westinghouse Electric and Manufacturing Co., Frederick S. Martin proposes splitting copper strips so as to form loops which, when expanded to embrace the requisite number of slots, can be interconnected at the unsplit portions so as to form a short-

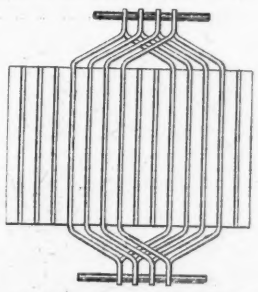


Fig. 6.—Induction Motor Winding.

circuited winding. The slotted strips have notches at their ends into which short-circuiting end rings are sprung. The whole forms thereby a squirrel-cage winding which will very easily withstand high-speed operating conditions.

SCIENTIFIC AND INDUSTRIAL RESEARCH.

The first annual report of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research, to which we referred last week, was published on August 31st. It is a document of some 50 pages, including five appendices, and covers a wide area, the treatment being somewhat discursive. It is summarised below.

After reviewing the policy pursued by the Government towards the encouragement of organised scientific support for trade and industry before the war, as exemplified by the inception of the National Physical Laboratory in 1900, with "its first modest capital grant of £13,000" and an annual allowance for maintenance of £4,000 (gradually increased to £7,000), which is compared with the Government grant of £100,000 a year to the American Bureau of Standards, the contribution of the Treasury to the expenses of the Engineering Standards Committee, the development of scientific research at the Imperial Institute, and the more generous Government support of the Imperial College of Science and Technology, the Report refers to the inadequacy of the national provision for scientific research, which was only brought home to the authorities by the shock of the great war, when it was found that we were unable to produce at home many essential commodities, such as optical glass, dyestuffs, &c. A Committee appointed by the Board of Trade on August 25th, 1914, to deal with the production of dyes, with the aid of capital supplied by the Treasury and a grant of £100,000 for research, was the first outcome of the Government's awakening, and in May, 1915, the Boards of Trade and Education announced the impending appointment of an Advisory Council for the encouragement of scientific research in relation to industry. Explaining the details of the scheme in July, the President of the Board of Education remarked that the brains and processes that were necessary that day to the output of munitions had been, and would again be, needed for the arts of peace, and unless the matter were dealt with at once it would not be possible to bring into operation an effective system in the difficult period of reconstruction that would follow the war.

"Accordingly the Council decided to give science in its applications to industry precedence over pure science in their deliberations. They are under no misapprehension as to the relations between pure and applied science. It has been said that what people call applied science is nothing but the application of pure science to particular classes of problems. And, properly speaking, this no doubt is so; there are not two different kinds of science. At the same time, the Council realise that they have to deal with the practical business world, in whose eyes a real distinction seems to exist between pure and applied science. The average manufacturer is impressed with the importance of quick returns; he cannot afford to wait. . . . Apart from the long period of work and preparation which a properly organised research laboratory attached to a factory involves before important results can be looked for, and apart from the risk that an unsuitable director of such a laboratory may involve a firm in heavy pecuniary loss, there is the plain fact that 'the difficulties that present themselves to manufacturers or merchants seldom afford an indication of the true nature of the problems to be solved. They are generally secondary in their nature, and a direct attack on them is likely to be as empirical as the symptomatic treatment of disease.' Thus such quick-result inquiries as the manufacturer is induced to make are very likely to be fruitless and to reduce his enthusiasm for science still further."

Another consideration which alone would have compelled the Council to begin with research of directly industrial application was that the universities, which are the natural homes of research in pure science, had been so depleted of both students and teachers by the war that they were barely able to continue their routine work, and any effective encouragement of research in pure science must await the return of peace.

Inquiries showed that there were certain researches being conducted or directed by professional associations in the period preceding the war which stood in grave jeopardy of enforced abandonment. These investigations had been paid for by the voluntary contributions of several great engineering and other professional societies, and thus carried with them the best guarantees of their necessity and effectiveness. The Council decided, therefore, to save as many of these derelict researches as possible, and accordingly recommended the payment of a series of grants to the societies concerned.

The chairman and other officers of the Council have interviewed representatives not only of the Royal Society and the Chemical Society, but of all the principal engineering societies throughout Great Britain, and other important professional societies, in all cases with gratifying results. The engineering trades have long been alive to the need and value of scientific research, while the chemical and textile trades had made less progress in the systematic use of science. But now there are signs of a change, and already textile research into the electrification of fibres during manufacture is proceeding at the University of Leeds with funds provided by the Textile Institute, and proposals are before the Council for fundamental researches into the cellulose fibres which form the basic material of the cotton and paper trades.

While these inquiries and interviews were taking place, the Council had invited the assistance of the universities and technical colleges of the country in the formation of a register of researches actually being conducted on the outbreak of the war. A careful survey of the amount and the character of the provision made in our higher educational institutions for research work is being made as a part of the Council's preparatory arrangements for a systematic programme of aid to individual researchers. It is hoped that the register will enable suitable workers to be rapidly found when proposals for special lines of inquiry come before the Council, and that a survey of the directions in which research is now proceeding in our universities and colleges may enable the Council to make helpful suggestions to individual workers from time to time, as the need for research in particular directions becomes apparent.

The Council also has under consideration the possibility of inducing firms in some industries to assist the progress of research by informing it in confidence of the problems they have in hand or in contemplation. Knowledge even of negative results may be valuable as a saving of time or as helping to determine more hopeful directions of attack. Even this modest degree of co-ordination will be abortive unless the principal manufacturers are willing to trust the discretion of the Council. There are indications of a change of view among certain firms which give hope that a more far-reaching co-operation may be possible, and the necessities of the war have led to an exchange of information once tenaciously reserved,

which may survive the present critical days. Some manufacturers at any rate are beginning to realise that their most numerous and dangerous enemies are not their fellow-countrymen engaged in the same trade, but powerful combinations of manufacturers in other countries supported by every device of rate and tariff that their Governments can provide.

Any assistance that the industries, or even individual firms, can give, from their accumulated experience, in bringing science to bear rapidly upon manufacturing problems will be of benefit to the trade as a whole, and indirectly, if not directly, of advantage to each manufacturer. In the numerous conferences the Council has had with representatives of different industries, it has been impressed with the spirit of co-operation which is growing up and the willingness to accept suggestions for the initiation of research for the benefit of the trade as a whole. Co-operative research, when it has done its utmost, will always leave ample room for individual initiative and ability in the application of its results, more than sufficient as an incentive and as a means to outstanding success.

Almost all advanced students left in the faculties of science and technology are working for the Ministry of Munitions, the Admiralty, or the War Office; the Council directed its officers to make systematic inquiry in the universities and technical colleges as to the existence of any students or teachers not engaged on war duties who might be retained for scientific research, whether pure or applied, if the Council would assist them. Among the duties assigned to the Council is the formulation of proposals for the establishment and award of research studentships and fellowships. The Vice-Chancellors and Principals or Deans of Faculty were accordingly asked to consult the heads of their several departments and to submit proposals, making it clear that with the heads of the departments and not with the senates or faculties or other university authorities would rest the responsibility for the recommendations put forward. The responsible professors and teachers have in nearly every case exercised great care and discretion in making their proposals, and nothing could show in more lamentable and honourable clearness the service of the universities to the country in the hour of her need than the resulting list. The Board of Education and the Scotch Education Department had been able to retain with the concurrence of the military authorities a certain number of advanced students in science, technology, and medicine, who were medically fit, because it had been foreseen that they would be required in the several national war services as they completed their studies. But all these and more than these were needed, and from the small remainder not taken for urgent scientific work the Council has only been able to recommend grants to some 40 individuals, amounting in all to a sum not exceeding £6,000.

The Council hopes to bring more reality into those academic laboratories which are now much dominated by the text-book and the syllabus of examination, and so encourage a better professional training for chemists, physicists, and other men of science. It also hopes to give assistance in correlating the researches being made into the same problem by encouraging the interchange of information; in industrial research, especially in the circumstances in which this country now finds itself, it would be deplorable if those engaged in working on the same subject at different public institutions were not to keep each other informed of the progress made. At the same time, it is recognised that there is a danger in bringing technical problems too pressingly to the notice of teachers and students in educational institutions. It is desired so to order the relations of workers in pure science to the industries going on around them that they may receive the stimulus of a wider outlook than is always attainable under the limitations of an academic system of syllabus and examination. In this way it may be possible in the end to create such an atmosphere that the new generation of students will cease to draw a distinction between "theory" and "practice," and technologists of all ranks will through them attain to the view that sound practice is only theory tempered by compromise.

Owing to the relatively high organisation of the engineering profession in relation to the several branches of the engineering industry, a number of researches bearing on industrial engineering problems was already in progress before the establishment of the Council, and a considerable number of applications for aid to new researches was received immediately it got into touch with them. These facts and the representations of the societies urging the establishment of stronger machinery for dealing with the manifold aspects of engineering research, led the Council at once to set up a series of strong standing committees to assist it.

Standing Committees have already been set up on Metallurgy, Engineering, and Mining. Each of the committees consists of about 15 members, of whom approximately half have been nominated by the professional societies concerned, the remainder being appointed directly by the Council. The Committees were appointed in the first instance for the period of one year in order to facilitate any changes in constitution or terms of appointment that experience might suggest.

The Council hopes with the assistance of the standing committees, the professional societies, the Home Office, and the Board of Trade gradually to construct panels of names which will enable it to obtain the very best advice on the different aspects of the problems it is called upon to solve.

The number and scope of the standing committees will need extension from time to time, but the absence of strong professional societies working in conjunction with the other scientific industries in this country makes it inadvisable to proceed hastily in so important a matter.

(To be continued.)

WAR ITEMS.

A.E.G. Electrical Co., of South Africa.—Under the Enemy Trading Act, the A.E.G. Electrical Co., of South Africa, Ltd., has been ordered to be wound up, and Messrs. J. G. Carter and H. P. Webber, accountants, have been appointed liquidators.

Work for Civilian War Prisoners.—It has now been decided that civilian prisoners of war may be employed on work not connected with the war, in several ways. In suitable cases, in the internment camps, they will be allowed to do work, on materials supplied by employers, which does not require elaborate plant or equipment; or, a number of prisoners may be specially interned in suitable premises, where they can live and work on some process of manufacture, if the employer is willing to install the necessary plant and provide the technical supervision required. Proposals to employ fewer than 100 men under an arrangement of the latter kind cannot be entertained, as a rule, owing to the cost of guarding the prisoners. The employer must pay the regular rate of wages paid to British workmen for similar work. A deduction will be made for maintenance and other expenses, and the balance will be credited to the man.

The Employment Department of the Board of Trade is prepared to receive from employers inquiries and proposals, and to make the necessary arrangements with the authorities concerned. Inquiries should be addressed to the Assistant Secretary, Board of Trade Employment Department, Queen Anne's Chambers, Broadway, Westminster, S.W.

Tramways and Lighting Restrictions.—At a Northern Police Court a ratepayer complained that the municipal authorities permitted flashes of light to be emitted from the overhead wires of the electric tramway system during the hours of restricted lighting. He considered the flashing when the trolley was being changed to be a danger to the town. Moreover, the cars were running at night without blinds. The Magistrates' Clerk, in advising complainant to keep a record of such incidents, secure witnesses, and lay an information, said it was rather an absurd thing that these lights were flashing at night, when all other lights were obscured. The Chief Constable: I agree. I believe the tramways manager is doing what he can. I have not seen it myself, or I should have done something.

A Labour Exchange Proposal.—Great antagonism has been aroused throughout the North of England by a proposal which has been extensively promulgated by highly-placed Labour Exchange officials that, after the war, the whole system of the engagement of labour for any purpose should be in their hands. Startling as it may appear, the proposal is that it should be made a penal offence for any person to offer service to an employer, or any employer to take a person into service, except through the Labour Exchanges. The *Yorkshire Post* has energetically sounded the note of alarm, and has ascertained the views of the chief employers and trade union leaders in the great industries in regard to the matter, with the result of the accumulation of a striking mass of condemnation of the proposal from both employers and employed. It is believed in the North that the proposal has its origin in Socialistic circles in London, where it has been determined to take permanent advantage for Socialistic ends of the disturbance of normal employment conditions caused by the war.

Ministry of Munitions: New Order.—In pursuance of the powers conferred upon him by Regulation 30 (A) of the Defence of the Realm (Consolidation) Regulations, 1914, the Minister of Munitions orders that the war material to which the Regulation applies shall include war material of the following classes and description, namely:—

All machine tools and machinery driven by power and suitable for use in cutting, stamping or working metal, including:—Lathes, milling and drilling machines, planers, shapers, screw machines, chucking, boring, slotting, and grinding machines, boring and turning mills, power presses, punching, shearing, forging, cutting-off, gear-cutting, and centring machines.

The Minister of Munitions gives notice (1) that he permits all persons until further notice to purchase or enter into negotiations for the purchase of the war material referred to in the above Order, provided that such purchase or negotiations are from or with persons holding a special permit from the Minister to sell such war material and not otherwise; and (2) that he permits the insurance of any such war material. All applications for a special permit in connection with the above Order should be addressed to the Director of Machine Tools, Armament Buildings, Whitehall Place, London, S.W.

Boy Munition Workers.—The Rev. R. R. Hyde has been appointed by the Ministry of Munitions Organising Officer of Boys' Welfare. The employment of boys in large numbers in factories has rendered it desirable that special provision should be made for their welfare.

Controlled Establishments.—The Minister of Munitions announces that he has made further orders under the Munitions of War Acts, 1915 and 1916, under which 161 additional establishments have been declared controlled establishments. The total number of controlled establishments under the Munitions of War Acts, 1915 and 1916, is now 4,212.

Italy Ousting the German Trader.—The Government has ordered the Prefects throughout Italy to compile lists of all business concerns in which Germans or Austrians are in any way interested, with a view to their sequestration, and the Administration has specially instructed the officials to trace all cases in which fictitious Italian or neutral nominees have been left in charge, with the view of destroying Germany's after-war hopes and of giving Italy economic freedom.

Exemption Applications.—The Bury (Lancs.) Tribunal recently heard an appeal by Mr. W. Clough, tramways manager, on behalf of a motorman. It was stated that if one man were taken away it would mean the withdrawal of a car from the service, and 8,000 workpeople were carried regularly on the cars. Conditional exemption was granted.

At a sitting of the Carnarvonshire Tribunal, on August 22nd, the Military representative appealed against conditional exemption granted by the Gwyrfai Tribunal to five employés of the Marconi Wireless Co., at Cefndu. It was contended that the local Tribunal had no power to grant exemption, but it was intimated that the men would not be called up until the department that employed them authorised their calling up, which was equivalent to exemption. The certificates were withdrawn on this understanding.

Folkestone Tribunal has allowed two months' exemption to a stoker appealed for by the Electric Supply Co.

Before the Hants Appeal Court, Mr. P. Grover, of Messrs. Grover, Smith & Willis, electrical engineers, of Basingstoke, appealed against final exemption until October 1st granted by the local Tribunal. It was stated that Mr. Smith, a partner, had been given conditional exemption, and that Mr. Willis was engaged in an Admiralty factory. As the Ministry of Munitions had requested the firm to carry out certain work, the appeal was put back to see if Mr. Grover becomes badged.

The Isle of Thanet Tramway Co. appealed, at Broadstairs, for an electrical engineer (18), engaged at a sub-station; the supervisor of sub-stations (25); an electrical engineer (28), in charge of a sub-station; a sub-station attendant (33), four car drivers, a permanent-way labourer, a ticket inspector and driver (36), a traffic inspector and driver (38), and a storekeeper (31). The manager said that he did not think that the Board of Trade would allow women to drive cars on their line. If the military would co-operate in giving substitutes, he was quite willing to release the men. The Military representative intimated that he was endeavouring to arrange for substitutes. The Tribunal exempted the supervisor of sub-stations, and put the other cases back for a fortnight with a view to substitutes being found. Prior to the war the company had 274 men; now they have 91.

The Skipton Tribunal has granted final exemption to September 30th to a partner in a firm, who is consulting engineer to several public companies and the local hospital.

Torquay Tribunal, on the appeal of the Corporation, has exempted a fireman at the electricity station so long as he remains in his present occupation.

At Diss, the Electric Supply Co. appealed for the manager, and conditional exemption was conceded.

Richmond-on-Thames Tribunal has given a local electric light contractor exemption until October 1st, to allow him to complete contracts in hand.

A Boscombe electrical engineer, appealing at Bournemouth for time to complete contracts and to get in debts, has been granted until October 1st final. The same Tribunal conditionally exempted an electric wireman, who has only one eye, appealed for by a firm who have lost 11 out of 12 men.

The Swindon Tribunal has conditionally exempted B. J. Rowland (35), electrician with Messrs. Hutton Bros., the only man left with the firm.

The Rugby Urban Council appealed to the local Tribunal for exemption for the man in charge of the refuse destructor. The Chairman asked the Military representative if it was wise to jeopardise the health of the town for the sake of one man for the Army. Conditional exemption was granted.

The Lewisham Tribunal adjourned for three weeks, with the object of a badge being obtained, an appeal by Mr. R. P. Mills, electrician, who stated that he was engaged on Government work.

Mr. J. L. French appealed at Bexhill-on-Sea for exemption for an electrical wireman, stating that he had lost six out of seven men. Exemption refused.

Twenty-six employés were appealed for at Oxford, on August 31st, by the Electric Tramway Co.; the Military representative offered no objection to temporary exemption for drivers, and suggested with regard to the traffic superintendent and inspectors, that three under 30 should go into the Army, and the other two be left to the company. It was pointed out that the inspectors were also drivers. The Tribunal granted conditional exemption to all except four.

Messrs. W. Lucy & Co., Ltd., appealed at Oxford for absolute exemption for D. G. French (18), brass fitter, engaged on electrical switch work for a new factory. It was stated that French two years ago replaced a man who had gone into the Army. The firm had lost 75 men. As a badge had been applied for, the case was adjourned for a month.

At Oxford, the question of unstarring R. J. J. Child (23), electrician with Mr. J. Goundrey, was considered. The star was granted on February 24th, and Capt. Baldry said that they had instructions from the War Office that no man, no matter what his age or occupation, was to be considered starred. The only men now exempted were those who held a certificate from the Ministry of Munitions. The Tribunal decided that Child should go before the Medical Board. The same decision was arrived at in the case of A. E. D. Chaundry (22), electric wireman with Messrs. Hill, Upton & Co., electrical engineers.

At Dawlish (Devon), the Electric Supply Co. applied for exemption for the manager and secretary, Mr. C. C. Hodges, who has already had three months' postponement. Mr. D. Anderson, director of the company, stated that they had advertised for a successor, but had been unable to fill the post. Exemption was extended until the end of November.

The East Kent Appeal Court has rejected a Military appeal against exemption granted to a stoker at the Margate Corporation dust destructor, on the ground that he is indispensable.

At Blackpool, exemption until the end of September was allowed the foreman of a firm of electrical engineers; the same Tribunal granted exemption until the end of October to a tramway motor-man, employed by the Corporation.

At Blackburn Military Tribunal, on August 30th, Mr. T. Barton, electrical engineer, applied for an assistant who had sole charge of a motor plant at large works in Darwen. Conditional exemption was granted, though an application for an apprentice in charge of an electrical plant in a colliery, by the same employer, was dismissed.

At Macclesfield, on Wednesday last week, an electrical engineer in business on his own account appealed; he had important work in hand at local factories, and three months' exemption was granted.

At Bath, the Electric Tramway Co. appealed for a driver. The manager said that owing to shortage of staff, 25 per cent. of the service had been stopped. Conditional exemption was allowed.

BUSINESS NOTES.

Copper Prices.—The week's changes. Messrs. F. Smith and Co. report: Wednesday, September 6th. Electrolytic bars rose from £129 to £130; ditto sheets, from £147 to £148; ditto rods, £136 to £137; ditto H.C. wire, 1s. 4 1/16d. to 1s. 4 1/8d.

Messrs. James and Shakespeare report: Wednesday, September 6th. No changes in prices quoted last week.

"Empire-Made Goods" in N.Z.—U.S. Consul-General Winslow states that a campaign for Empire-made goods has been started in Auckland, New Zealand, and is likely to spread all over the Dominion.

The Auckland Provincial Industrial Association has taken the matter in hand, and a Committee has been appointed to organise the work, with the idea of securing the co-operation of all merchants, manufacturers, storekeepers, and others in carrying into effect an attractive demonstration in favour of Empire-made products. The financing of this scheme, which is expected to cost from $4,000 to $5,000, is to be taken over by the merchants and manufacturers of the city.

Johannesburg Municipal Power Station.—Referring to Mr. Dobson's paper, reprinted on page 231 of our last issue, Messrs. Erith's Engineering Co., Ltd., inform us that the Erith stoker referred to was the old type for intermittent cleaning, and was installed seven years ago, in 1909; it was supplied to the unconditional order of a Johannesburg firm, and duly paid for; it was identical with stokers supplied in 1906 and 1907 to Durban electricity works. Burning about 25 cwt. hourly of Transvaal coal, cleaning took seven minutes every four hours; and as Mr. Dobson says, it showed great flexibility, needed no arches, and combustion was as nearly as possible perfect. The modern Erith-Riley stoker retains these advantages, with the added feature of continuous automatic discharge of ash and clinker; this improved stoker has been installed at Edinburgh, Hull, Worcester, West Hartlepool, Luton, and many other power stations.

Catalogues and Lists.—MESSRS. KELVIN, BOTTOMLEY AND BAIRD, LTD., 16-20, Cambridge Street, Glasgow.—New pamphlets on industrial pyrometers of the thermoelectric type, and switchboard moving-coil and moving-iron instruments of various patterns.

MESSRS. J. & W. B. SMITH, 15, Farringdon Road, E.C.—Catalogue of electric flash lamps and batteries.

MESSRS. S. B. GOSLIN & SON, 13, Artillery Lane, E.—Leaflet showing that they pour castings daily in iron, brass and other metals.

The Russian Electrical Market.—The Russian journal *Elektrichestvo* recently published an article on the Russian market for electrical goods which is of some significance to British manufacturers. The Russian imports of German electrical goods, it says, represented in 1909 a sum of £700,000, and in 1913 £1,700,000. The war has, however, forced Russia to seek other suppliers, and importers have turned to England. Unfortunately, that country has not been able or willing to take any particular interest in the Russian market. The Germans exported to Russia in 1913 12·6 per cent. of their whole exports of electrical machines, while England sent only 2·7 per cent. of her exports of these articles. Thus Germany sold to Russia six and a-half times more than England. Russians are now thinking of looking to the United States, and regret that the English will not consider their market, probably because of the reputation for commercial punctuality of Russians not being good. The article discusses this side of the subject, explaining that this belief is erroneous, and affirms that England has every reason to seek an outlet for her machinery in Russia, as disregard of the opportunity can only end in forcing Russian importers to resort to the United States.

As a matter of fact, it is stated that America is already profiting by the opportunity afforded for capturing the Russian market. American agents have already taken orders for considerable quantities of telegraph and telephone apparatus and many tons of copper wire. There is a strong demand for small motors of from ½ to 4 H.P., for educational electric appliances, for X-ray apparatus, and for every kind of electrical material. It seems that a month ago it was impossible to purchase a single battery cell in the whole of Petrograd, and it is the opinion of many American agents that the Russian market can absorb huge supplies in the future. Between 125,000 and 150,000 German merchants are interned in Siberia, and the Russians earnestly desire that the Americans shall take their places. Three-fifths of Russian capital has indeed been offered American firms if they will contribute two-fifths, in order to establish manufactures in Russia.

According to some reports, it is possible to sell direct and thus eliminate the commission agents. The abolition of vodka is said to have greatly improved credit, so that sales are now effected for cash without difficulty; while the deposits in savings banks have risen 1,100 per cent. as a result of the better economic situation of the country.

The large field which Russia affords for hydro-electric engineers and manufactures is shown by the fact that in European Russia, including Finland, and in the Ural and the Caucasus, the utilisable hydraulic power is estimated at about 10,000,000 KW., while the amount utilised is less than in any other country in Europe. In round figures, only between 180,000 and 220,000 KW. is developed, of which 1·80 per cent. consists of small installations.

According to an Italian report, the Germans neglected to develop Russia's water wealth, in order to preserve a market for their own manufactures; the French prefer to lend capital to the Russian Government, rather than concern themselves with the development of local Russian industries; while the wilful abstention of Great Britain leaves the great Russian market to go begging to whatever country chooses and has the initiative to take it up.

Dissolutions and Liquidations. — ELECTRICAL OIL REFINING CO., LTD.—This company is winding up voluntarily with Mr. J. E. Frost as liquidator; a meeting of creditors is called for September 8th, at 29, Great St. Helen's, E.C.

HIGH-TENSION INSULATORS, LTD.—A meeting will be held at 32, Sackville Street, W., on October 3rd, to hear an account of the winding-up from the liquidator, Mr. G. T. Broadbridge.

C. DALES & SONS, watchmakers, jewellers, opticians, and electricians, 113, Poole Road, Bournemouth.—Messrs. C. and T. H. Dales and C. Dales, jun., have dissolved partnership; Messrs. C. & T. H. Dales will attend to debts and continue the business under the same style.

THE PHŒNIX ELECTRICAL CO. and the CALEDON ELECTRICAL CO.—Notice is given in the *Edinburgh Gazette* that these companies, of which Robert Walker and Thomas Henry Large were the sole partners, have been dissolved by mutual consent as at August 3rd, 1916. Messrs. Thomson, Jackson, Gourlay & Taylor, chartered accountants, 24, George Square, Glasgow, are authorised to attend to all debts due to the dissolved firms, and will discharge their liabilities. Mr. Walker will carry on business for his own behoof at 2, Oswald Street, Glasgow, under his own name, and Mr. Large will carry on business at 40, Broomielaw, Glasgow, under the name of the Phœnix Electrical Co.

MOND NICKEL CO., LTD.—A meeting will be held at 39, Victoria Street, S.W., on October 11th, to hear an account of the winding-up from the liquidator, Mr. R. Mathias.

HERBERT FROOD CO., LTD. (the predecessor of the present company of the same name and title).—A meeting will be held at the Sovereign Mills, Chapel-en-le-Frith, on October 12th, to hear an account of the winding-up from the liquidator.

TYNESIDE ENGINE WORKS (CARDIFF), LTD.—A meeting will be held at Bute Docks, Cardiff, on October 6th, to hear an account of the winding-up from the liquidator, Mr. W. P. Annear.

Book Notice.—*Science Abstracts*, A and B. Vol. XIX, Part 8. August 24th, 1916. London: E. & F. N. Spon. Price 1s. 6d. each part.

British Goods for France.—It is announced by the Board of Trade that, in agreement with the British Government, the French Government has just set up at King's House, Kingsway, W.C., a special office for the issue of licences for the importation into France and Algeria of goods of British production or manufacture which are included in the list of articles prohibited to be imported into those countries.

Sale.—On September 13th and 14th there will be a sale of electric plant, tools, and machinery at Millwall. Particulars are given in our advertisement pages.

Bankruptcy Proceedings.—JAMES REID WHITEHOUSE, 43, St. Andrew's Road, Golder's Green, Middlesex, managing director of an electrical company. The following are creditors:—

Sun Electrical Co., London	£233	Rose & Ford, London	£14
Electrical Co., London	44	Cannon Brooke, London	8
Armorduct Co., London	125	Russell, M., & Co., London	105
Falk, Stadelmann & Co., London	15	Pocock & Son, London	20
Gurney & Co., London	40	Schroeder, —, London	4
Acton Lamp Co., London	10		

Australian Tariff Revision. — The Government has approved a definite policy to give Australian industries a measure of protection by revising the tariff schedules in such a way as to create an effective and substantial barrier against the inundation of imports, which for years has had a paralysing influence on industry in this country. The Government will ask Parliament to impose duties on manufactures that can be produced by Australian workmen, sufficiently high to avoid the stifling influence of competition with the outside world. There is a probability that after the fixation of duties in relation to importations from the United Kingdom, second preference will be shown to the Allies, with a third scale for neutrals and a prohibition against enemies.—*The Age.*

LIGHTING AND POWER NOTES.

Aberdeen.—YEAR'S WORKING.—The report of Mr. J. A. Bell, the city electrical engineer, on the year's working of the electricity undertaking to July 31st last, shows that 15,004,420 units were generated, as against 12,475,920 in the previous year, and the total income was £75,873, an increase of £15,642. The working expenses amounted to £39,180, leaving a gross balance of £35,682. After payment of interest on capital, £9,717, instalment of sinking fund, £18,183, and depreciation on motors, &c., £1,041, there remained a net profit of £8,792, an increase on 1915 of £4,157; this has been placed to reserve fund, which now stands at £39,119. The increase in output for the year had only once been exceeded in the history of the undertaking, and the motors connected were largely in excess of the previous year. The revenue account showed a total increase of £15,840; of this £7,555 was due to increased charges, the remainder being new business; increased costs, amounting to £11,268, were principally due to the extra cost of coal and the all-round increase in supplies, &c. The reserve coal stock has been increased by 1,500 tons during the year; with the 120 new customers added, the total number connected to the mains is 3,474.

PRICE REDUCTION.—At a meeting of the Electricity Committee it was proposed that the rate for lighting should be the ordinary rate, plus 5 per cent., and the rate for power the ordinary rate, plus 20 per cent., being a reduction of 5 per cent. in each case compared with last year.

Accrington.—The Electricity Committee has instructed the electrical engineer to carry out the conversion of a boiler, in lieu of purchasing a new air-cooler for the 2,000-KW. turbo-alternator, at an estimated cost of £60.

Ayr.—The estimates of the Corporation electric light department for 1916-17 show a debit balance of £1,650, arising from increase in the price of coal and restricted lighting consumption.

Canada.—The recent Government report on the power possibilities of the Winnipeg River, in Manitoba, shows that over 400,000 H.P. could be developed at various sites within easy transmission distance of Winnipeg. At the present time two power developments are in existence, viz., that of the Winnipeg Electric Street Railway Co., which is 58 miles from the city, on the Pinawa Canal, and comprises nine turbine units developing 28,000 H.P., with a 60,000-volt transmission, and that of the city authorities at Point du Bois, where there are five 3,000-KW. units and three 5,000-K.V.A. units giving about 25,000 H.P., which can be increased to 77,000 H.P., with additional plant. In this case the transmission is at 66,000 volts, and the direct distance 75 miles. There are other seven sites, which could be exploited, and with the present unregulated flow of 12,000 sec. ft. nearly 250,000 H.P. could be obtained, while if the river were regulated to maintain a minimum flow of 20,000 cb. ft. per sec., it is considered that some 418,000 H.P. could be obtained.

The seven sites referred to, and the H.P. with 12,000 and 20,000 cb. ft. per sec., are as follows:—Pine Falls, 37,900 and 63,100 H.P.; Du Bonnet Falls, 57,300 and 95,500 H.P.; McArthur Falls, 18,400 and 30,700 H.P.; Lower Seven Sisters, 12,600 and 37,900 H.P.; Upper Seven Sisters, 9,900 and 29,600 H.P.; Upper Pinawa, 12,300 and 12,300 H.P.; and Slave Falls, 26,600 and 44,400 H.P. The falls vary from 18 to 56 ft., and the distances from Winnipeg from 52 to 74 miles. The cost of developing these sites with the low flow is estimated at £2,664,000, and with the high flow at £4,909,000, and the power costs at 100 per cent. load factor at ·65 and ·59d. per unit respectively, or at 50 per cent. load factor at ·13d. and ·118d. respectively.

The development of the Du Bonnet site has already been taken in hand by the Winnipeg River Power Co., which is controlled by the same interests as the Winnipeg Railway. The plans for this plant — called the Great Falls Development — include eight 21,000-H.P. turbines with 11,000-KW. generators, and an 110,000-volt transmission to Winnipeg.

While Winnipeg is well off for water power, Calgary also has within 50 miles, 48,100 H.P. available, and the Western Canada Power Co. at Stave Lake, 35 miles from Vancouver, has a possible development of 100,000 H.P.

Chile.—By decree of July 1st, 1916 (Ministry of Industry and Public Works), an honorary Commission was appointed to make a study of the water power available in Chile for the purpose of hydro-electric development.

The local Press quotes the estimate of Prof. Don Arturo E. Salazar, of the University of Chile, that proper hydro-electric development in Chile would reduce the cost of electricity for the small consumer for commercial purposes from the present price of 70 centavos gold ($0.255 United States currency) to 3 centavos gold ($0.01095).—*American Consular Report.*

Continental.—Norway.—According to the *Elektrotechnische Zeitschrift*, electrotechnical plants in Norway have rapidly increased in number and importance in recent years. The following are figures taken from recent official publications :—

	1st July— 1913.	1915.
Generating plants	1,310	1,515
Generator capacity, KW.	457,879	649,127
Batteries, No.	151	137
Ditto, capacity, KW.	13,934	19,304
Power taken by motors, KW.	159,091	216,809
Ditto by electrochemical works, KW.	199,690	304,128
Ditto by other users, KW.	16,841	29,603
Apparatus installed, No. glow lamps	1,303,302	1,965,440
" " " arc lamps	4,774	3,603
" " " motors	16,460	24,689

The table shows the remarkable reduction in arc lamps, the steady increase in glow lamps, and the falling off in accumulator batteries, with the concurrent considerable increase in the energy utilised in the electrochemical industry. The average power of the installations, which was 350 KW. in 1913, advanced to 430 KW. in 1915. At the present moment there are installed in Norway 0·8 glow lamps and about 0·09 H.P. of motors for every inhabitant.

Dundalk.—Railway Supply.—The U.D.C. held a public inspection, last week, of the addition to the power house which is to supply electricity to the railway locomotive works. Five 320-H.P. engines are now installed. The contract with the railway company commenced on September 1st, and it is estimated that when the scheme is fully working, the output of the station will be the fourth on the list of Irish cities, ranking after Dublin, Belfast, and Cork.—*Irish News.*

Eastbourne.—Price Increase.—The T.C., on Monday, decided to increase the price of energy by ½d. per unit as from October 1st.

Glasgow.—Coal Supply.—In view of the scarcity of coal the Electricity Sub-Committee on the purchase of coal has met and conferred with the District Coal and Coke Supplies Committee for Scotland, with a view of obtaining its assistance in getting adequate supplies of coal for the electricity department, and the latter has undertaken to use its influence with contractors for getting delivery of supplies in arrear, and also for getting adequate supplies of coal for the current year.

Greenock.—Power Supply.—A large number of new consumers have lately been added by the Corporation electricity department, comprising firms having small workshops and factories with electric motors ranging from 2 to 100 H.P. The motors now supplied from the department's mains represent some 27,000 H.P.

Hedworth.—Street Lighting.—The Leicestershire and Warwickshire E.P. Co. has notified the P.C., agreeing to carry on the public lighting on the terms suggested for the time being (£1 per week for a dozen or less lamps).

Hexham.—Price Increase.—The Hexham and District Electric Supply Co. has given notice that, from October 1st, the charges for electricity for lighting will be raised 1d. per unit, and for lighting and power by ½d. per unit.

India.—The Calcutta Electric Supply Corporation has installed a B.T.H. turbo-alternator of 6,000 KW. normal, and 7,500 KW. overload, capacity. The turbine has 11 stages, and is designed to run at 1,500 R.P.M. on steam of 150—170 lb. pressure superheated 100° F ; it exhausts into a surface condenser designed to maintain a vacuum of 27½ in. The generator supplies three-phase, 50-cycle current at up to 6,500 volts. A similar turbine plant is to be installed by the Bombay Electric Supply and Tramways Co.

Further information regarding the new Tata hydro-electric scheme for Bombay shows that if a separate company is formed, it will work in close co-operation with the existing one. It is proposed to provide 60,000 H.P. in Bombay for 3,600 working hours per annum. An independent power house, transmission lines, and receiving station will be built, but will be interconnected with the existing installation, thus giving two practically independent sources of power. The plans entail a dam to raise the water 112 ft., the water being drawn off through a 9,100-ft. tunnel, giving an average working head of 1,735 ft. The reservoir storage will be 18,000 million cb. ft., of which 13,000 millions will be available for generating power. The same voltages of transmission and distribution are proposed as for the present installation.

The Mysore Government has provided a sum of Rs. 75,000 for the electrification of the Kolar Gold Fields pumping plant, and has sanctioned an expenditure of 1½ lakhs of rupees for electrifying the pumping stations of the Bangalore city, and civil and military station water supply, thus saving about 50 per cent. on fuel charges.—*Indian Engineering.*

Japan.—Electrolytic Plants.—A company has been formed in Osaka, with a capital of 353,000 yen, for the manufacture of caustic soda. It is stated that the company intends to use the electrolytic process, and is going to erect a factory at Kyushiu, where hydro-electric power is fairly cheap. The salt used will be Kwangtung monopoly salt, the price of which for industrial purposes is 63 sen per 100 kin (about 1s. 1½d. per cwt.). The machinery is to be Japanese. An output of 300,000 lb. of caustic soda per month is spoken of ; as a by-product, bleaching powder will be obtained. At present there are two companies manufacturing caustic soda in Japan, one at Yamaguchi, and the other at Tokio. They produce respectively about 3,500 and 400 tons per annum.—*Indian Textile Journal.*

Korea.—It is reported that business men of Tokio are planning a new hydro-electric company to utilise the water power of the Namchon River in the south of the Korean peninsula. The company will be capitalised at $1,500,000, and will purchase the rights of the present Taiku Electric Co. The plant of the company will be located at Hyopchon, South Kyongsang Province.—*Indian Textile Journal.*

Leeds.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £35,000 by the Corporation for extensions of electricity mains and new sub-stations on the understanding that the money will be expended in specified directions.

London.—The Notting Hill Electric Light Co. has issued a notice that from September 29th the company will make a minimum charge of 10s. for the supply of electricity through slot meters.

Manchester.—The Improvements and Buildings Committee of the Corporation has passed a plan for an addition to the transformer house at the Stuart Street generating station of the Corporation.

Ripon. — E.L. Scheme. — The City Council has appointed Mr. George Wilkinson, of Harrogate, to prepare the necessary plans and particulars for obtaining a provisional order for electric lighting for the city.

Salford.—The T.C. has been recommended to seal agreements for the supply of energy to Salford Electrical Instruments, Ltd., Zama, Ltd.; and Erskine Heap & Co., Ltd.

Shipley.—Linking-up Scheme.—The Sub-Committee appointed to consider the advisability of linking-up with Bradford, has considered the electrical engineer's report, which states that a small saving in coal would be effected, but he considered that there were serious disadvantages to the scheme. The Sub-Committee suggested that before a definite statement is submitted to the B. of T., there should be a further interview between the two authorities. The U.D.C. has approved of the Sub-Committee's recommendation to attend a further conference with Bradford.

Rochdale.—The long-drawn-out dispute between the Gas and Electricity Committee and Tyre Yarns, Ltd., and Fabric Weavers, Ltd., respecting the interpretation of a clause in the agreement of supply has been settled. The firms named contended that they were entitled to a rebate because another firm taking less electricity than they were was being charged on a lower basis. Failing a settlement the firms asked that the matter should be submitted to arbitration by the B. of T., in accordance with another clause of the agreement. The Electricity Committee decided to empower Sir John Snell to settle the dispute on behalf of the Corporation without resort to arbitration. The settlement reached is that the company shall pay for current up to March 31st last £7,673, instead of the £8,048 originally demanded ; this year's charges are to be revised downwards in accordance with the demand of the firms, but a small extra charge is to be made for current in excess of the contract quantity. The Committee also agrees to revise its contracts with three other firms, so that no consumer shall be supplied at cheaper rates than those included in the Tyre Yarns contracts, where the supply is given under similar circumstances.

Tasmanian Water-Powers. — Mr. Hartwell Conder, writing on the above subject in the *Australian Statesman and Mining Standard*, points out that the pioneers of hydro-electric work in Tasmania were the Launceston municipal authorities who secured 1,800 H.P. from the River Esk ; this scheme encouraged several other country towns and one or two mines to erect small plants, but all were dwarfed by the Great Lake scheme, promoted by the Hydro-Electric Power and Metallurgical Co., and, finally, taken over by the Government, the ultimate possibilities of which are estimated at between 50,000 and 100,000 H.P. Contemporary with this, the Lake Margaret scheme of the Mount Lyell Co. was

completed, giving 6,000 H.P., and a possible expansion to 10,000 H.P.

In view of these developments the writer goes on to discuss the total power available in the island, and summarises the various sources as follows :—

	H.P.
Class I.—	
Great Lake scheme	50,000 abt.
Mount Lyell Co.	9,000
Launceston T.C.	1,800
Class II.—Schemes partly surveyed :—	
Lake Rolleston	17,000
Stanley River	1,000
Class III.—Schemes superficially examined :—	
Sedgwick Valley	10,000
Lake St. Clair	40,000
Total	136,000

Other localities offering prospects are the Makintosh River, Gordon River, Arthur River, Forth River, and Mersey River. On the whole, it would appear that over 200,000 H.P. and under 400,000 H.P. is available.

Twickenham and Teddington.—PRICE INCREASE.—The Electric Supply Co., owing to the increased cost of coal, &c., has increased the price of energy to all consumers by 10 per cent.

Warrington.—ANNUAL REPORT.—The income of the electricity undertaking during the year ended March 31st last was £34,403 (compared with £25,419 for 1914-15), and the expenditure was £24,213 (compared with £16,858), leaving a gross profit of £10,190. The net profit was £2,395, which has been transferred to the appropriation account, making a credit balance of £9,424, after transferring £1,000 in aid of the rates and meeting expenditure on machinery and switchboard. The reserve fund now stands at £9,358.

Winchester.—PRICE INCREASE.—The T.C. has decided to increase the price of energy, as from the meter readings for the Michaelmas quarter, for lighting, power, heating, and cooking by 15 per cent. ; and for supplies by prepayment meters by 1d. per unit.

Worcester.—The Electricity Committee reports that it has been found necessary to accede to requests from the staff for extra pay for overtime and for increases of salaries and wages. The effect will be to add £148 a year to the wages bill.

TRAMWAY and RAILWAY NOTES.

Australia.—WAGES DEMANDS.—Close on 3,000 members of the Australian Tramway Employés' Association in Victoria, Tasmania, and Western Australia are concerned in fresh demands for increased wages, which have been served on the employers in those States. The bodies affected are the Melbourne Tramway Board ; Prahran and Malvern Tramway Trust ; Hawthorn Tramway Trust ; Melbourne, Brunswick, and Coburg Municipal Tramway Trust ; North Melbourne and Essendon Electric Tramways Co. ; Ballarat and Bendigo Electric Supply Co. ; and the Fremantle, Kalgoorlie, and Hobart tramway systems.—*Melbourne Age.*

Blackpool.—ACCIDENT.—An alarming smash occurred in Central Drive recently ; the vehicles concerned were a Corporation car on the Marton route ; a Blackpool, St. Anne's and Lytham car, and two motor char-à-banc from Southport. One of the latter had broken down and was being towed by the other, The front char-à-banc contained 28 passengers and the other 18. Both cars had to be removed to their respective depôts, the St. Anne's car being badly damaged.

Twelve car-lifting jacks are to be purchased and placed at suitable positions on the Corporation tramway system.

Bradford.—WAGES.—The Society of Tramway and Vehicle Workers has sent in an application for an advance of wages for drivers, conductors, and the parcel staff—based on the increased cost of living—the granting of which would incur an additional cost of £20,000 a year to the department.

Burnley.—DEPRECIATION ALLOWANCES.—Mr. Mozley, the tramway manager, has submitted a statement showing the the sums he considered it was necessary to set aside annually for depreciation :—Rails, amount expended £86,796, annual depreciation, £2,787 ; paving, £43,770, £845 ; overhead, £15,549, £331 ; depôt buildings, rails, &c., £44,061, £185 ; general offices, £3,000, £13 ; centre offices, £5,166, £22 ; waiting rooms, &c., £407, £7 ; machinery, £2,800, £50 ; tower wagon, £642, £32 ; house, Queensgate, £375, £1 11s. ; rolling stock, £54,647, £1,399 ; total amount expended, £257,213, total annual depreciation, £5,672.

Glasgow.—Representations in favour of a modified all-night service of cars were submitted by a deputation of the Springburn Ward Committee at the last meeting of the Tramway Committee. The basis of the appeal was the convenience that would accrue to the large number of workers engaged on nightwork in scattered parts of the city and environs.

The Tramway Committee, after considering the application of the drivers and conductors for a war bonus of 6s. per week, has agreed to raise the working hours to from 54 to 56 per week, with ordinary pay plus a bonus of 2s. per week to men and 1s. per week to women, and time and a-half overtime rates. The question of improving the car lighting is under consideration, so far as this is possible without infringing regulations.

Liverpool.—TRAFFIC RETURNS.—Big increases in receipts on the tramways were reported at a meeting of the Tramways Committee on the 1st inst. Since January 1st the receipts had amounted to £478,451, an increase of £23,912 compared with the corresponding period of last year, and the passengers carried had numbered 10,321,389 ; while the car-mileage was 8,322,190, a decrease of 58,531. For the past seven weeks the mileage was 1,715,251, a decrease of 9,338 compared with the corresponding period a year ago ; the receipts for the seven weeks were £107,320, an increase of £8,109, and passengers carried numbered 22,697,820, an increase of 1,415,315.

London.—P.O. TUBE RAILWAY.—With reference to the "Note" in our issue of August 25th (page 211) referring to the London Post Office Tube Railway, we are informed that Mr. Asquith's Parliamentary answer related solely to the construction of the tunnel, and in no way to the electrical equipment. Further, we understand that no invitation for tenders for electrical equipment has yet been issued, and no decision has yet been arrived at with regard to the system of electric traction to be adopted.

Manchester.—The Tramways Committee has decided to recommend the Council to apply to the B. of T., in accordance with the provisions of the Special Acts (Extension of Time) Act, 1915, for a further extension of the period limited for (*a*) the construction of the tramways, and (*b*) the compulsory purchase of lands for street widening, referred to in Sec. 31 of the Manchester Corporation Act, 1911. It has been decided that women guards be paid the annual advances as provided in the scale of wages in operation as regards male guards. Sir George Askwith (Chief Industrial Commissioner), in forwarding to the Corporation a letter from the Workers' Union respecting an application for an advance of wages for workmen in the permanent way department, suggests that the matter should be referred to the Committee on Production for settlement, and the Tramways Committee has agreed to the suggestion, and has instructed the general manager to prepare, and present the Committee's case at the arbitration. Corporation Committees are being recommended to follow the lead of the Tramways Committee, and allow an extra day's wages in lieu of the Whit Monday and August Bank Holiday, to workmen who, being entitled to holidays on those days, were working in accordance with the decision to forgo the holidays.

New Zealand.—The Palmerston B.C. has been authorised to raise a loan of £86,000 ; £66,000 will be devoted to an electric tramway undertaking, and £20,000 for an electric lighting installation ; the undertaking will not be proceeded with until the conclusion of the war.—*Board of Trade Journal.*

Salford.—WAR BONUSES AND RATE RELIEF.—Additional war bonuses are being recommended by the Tramways Committee for payment to tramway workers. If the recommendation is adopted it will mean an addition to the working cost of the department of over £2,774 per annum, and £1,804 to men serving with the Forces, and the total charge under this heading will be nearly £10,000. The Committee declares that probably the payment of the increased bonuses may prevent it from handing over at the end of the year the sum promised for rate relief.

TELEGRAPH and TELEPHONE NOTES.

China.—An American Consul reports that great improvement has recently been made in the service of the Chinese Telegraph Administration. New territory has been reached, and new offices have been opened in fields already covered. In order to ensure speed in the transmission of telegrams, the Wheatstone automatic system has been adopted on all trunk lines. In order further to accelerate the transmission of telegrams, three years ago the Administration began the installation of the automatic duplex system on its more important lines, the first installation being made on the Pekin-Tientsin line. In May and June this system was put into use between Pekin and Hankow, and Hankow and Shanghai. It is the intention of the Administration gradually to extend the duplex system.

Illicit Wireless Plant.—At Gisborne, N.Z., a boy, 16 years of age, named E. M. Goffe, was charged with erecting a wireless plant without the consent of the Government. Mr. Edward Goffe, father of the boy, was charged with aiding his son in committing the offence. Evidence was called showing that the plant, if properly fitted up, could send messages a short distance, and could receive from Auckland and Wellington. The offence was admitted as far as a technical breach was concerned. The magistrate fined the junior defendant £2, and costs 7s. The father was fined £10, costs 7s.

Telephone Register.—In future, Australian subscribers whose telephones are connected with an exchange in which the common-battery system is in use can obtain an automatic recording register, which will enable them to check the number of calls they originate. The instrument will be affixed to the subscriber's telephone, and the annual rental is 10s. at the outset. This boon will be available to a limited number of subscribers only. It has been decided to install the instruments on telephones connected with Central and North Sydney exchanges.

Women Wireless Operators.—At the beginning of the year the Marconi Co., with a view to determining the suitability of women as wireless operators, established a school at one of their stations. The school has been well attended, and the experiment is regarded as encouraging. Some of the pupils have been already drafted to stations, where they are doing very satisfactory work. Sending by female operators has a tendency to be too light, but it is thought that some of the learners will become quite efficient with more practice, that a number will prove very useful understudies, and that a proportion may turn out successes on the wireless circuit. Until these points can be determined, the work of the school will be discontinued for the present after September 30th.—*The Times.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—SYDNEY.—September 20th. N.S.W. Government Railways. One 50-ton electrically-operated overhead travelling crane for Zara Street power house, Newcastle. October 11th. One motor-driven air compressor for Zara Street power house. Electrical Engineer, 61, Hunter Street.

ADELAIDE.—September 27th. Deputy P.M.G. Telephones, telephone material, instruments and parts. Schedule Nos. 429 to 437.*

PERTH.—October 4th. Deputy P.M.G. Telegraph and telephone measuring instruments and parts. Schedule 501 W.A.*

MELBOURNE.—November 1st. Victorian Railways. 50,000 flame arc carbons. Chief Storekeeper, Railway Offices, Spencer Street.*

October 18th. Victorian Government Railways. Electric time releasing mechanisms for automatic signalling. Cont. No. 30,343.*

September 29th. City Council. Insulated and H.D. copper cables. See "Official Notices" to-day.

November 1st. For the Victorian Railway Commissioners, 50,000 yellow flame arc carbons.*

October 17th. For the Deputy P.M.G. (1) sleeves and tapes (Sched. No. 1,355), and (2) 3,100 stay-rods, with low tighteners (Sched. No. 1,359).*

Burnley.—September 19th. The B. of G. invites tenders for electrical goods. Tender forms from J. S. Horn, Clerk.

Edmonton.—September 20th. Electric lamps for six months. Mr. F. Shelton, Clerk. B. of G., Lower Tottenham.

Government Contracts.—September 8th (11 a.m.). Incandescent lamps for the Office of Works. See "Official Notices" to-day.

London.—Supply of electric light fittings for Australia House, Kingsway, W.C. Particulars from Mr. H. H. Turner, 48, Broadway, Westminster, S.W.

L.C.C.—September 15th. Asylum and Mental Deficiency Committee. Supply of electric lamps. Mr. H. F. Keene, Clerk, 2, Savoy Hill, W.C.

CITY OF WESTMINSTER UNION.—September 20th. B. of G. Six months' supply of electric lamps, fittings, &c. Mr. W. J. Liekley, Clerk, Gardens Offices, Princes Row, Buckingham Palace Road, S.W.

Manchester.—September 12th. Tramways Committee. (*a*) Permanent-way special trackwork, and (*b*) permanent-way point tongues and crossings. Specifications, &c. (£1 1s., returnable), Mr. J. M. McElroy, General Manager.

September 12th. Tramways Committee. Supply of pitch. Mr. J. M. McElroy, General Manager, 55, Piccadilly.

New Zealand.—INVERCARGILL.—September 28th. Borough Council. Steam turbo-alternator, condensing plant, and switchgear. Specifications from the Tramway Office. Contract No. 40.*

GISBORNE.—October 2nd. B.C. Cooling tower at the power station. Specifications from the Town Clerk.—*N.Z. Shipping and Commerce.*

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Australia.—The Sydney Municipal Council is recommended to accept the following tenders :—

Large motors for hiring out.—Four 40-B.H.P. semi-enclosed type motors complete, to be manufactured by the Electric Construction Co., £715; three 60-B.H.P. ditto, £652, B. Warburton, Franki, Ltd.; two 100-B.H.P. ditto, of American manufacture, £674, Aust. General Electric Co.

Steelwork for new workshop at power house, £4,609.—L. Scrutton and Co., Ltd.

Consumers' meters, 5 and 10-amp. and 50-amp., £3,987.—Standard Waygood-Hercules, Ltd.

Ten 5,000-volt feeder panels for the sub-stations at Lang Park, Philip Street, and the abattoirs, £1,840.—Australian General Electric Co.

Victorian Railways :—

Electrically-operated goods elevator for Jolimont car-shed, £860.—G. Weymouth Pty., Ltd.

Thermo-electric pyrometers complete, £62 13s. 6d. per set.—The Cambridge Scientific Instrument Co., Ltd.

1,000 amp.-hour storage battery, £267.—W. Adams & Co., Ltd.

—*Tenders.*

Glasgow.—The Sub-committee on Electricity Works recommends the purchase of two 5-ton motor-wagons, one from Edison Accumulators, Ltd., and one from the General Vehicle Co., at a total cost of £2,990.

Manchester.—The Tramways Committee has accepted the tender of Messrs. F. Smith & Co., Ltd., Salford, for copper trolley wire.

Salford.—Tramways Committee :—

Hadfields, Ltd.—Manganese-steel crossings, £220.

Electricity Committee :—

Lea Recorder Co., Ltd.—Steam recorder, £134.

Royles, Ltd.—Feed water heater, £115.

FORTHCOMING EVENTS.

Institution of Mining Engineers.—Thursday, September 14th. At 11 a.m. At the Royal Technical College, Glasgow. Annual general meeting.

THE BRITISH ASSOCIATION.—I.

FOR the fourth time in its history, the British Association for the Advancement of Science is meeting in Newcastle-on-Tyne, where the 88th annual gathering was inaugurated on Tuesday night, when the President (Sir Arthur Evans, D.Litt., LL.D., F.R.S., &c.) delivered his address on "New Archæological Lights on the Origins of Civilisation in Europe." The Association met in Newcastle in 1838, 1863, and 1889, and, but for the present disastrous war, this year's visit would have been of especial interest, particularly to the engineering section, for there have been, immense developments on the whole of Tyneside in all branches of that industry, and in none has this advance been more marked than in the electrical section, for the city forms the nucleus of one of the greatest supply systems in the country.

The first event in connection with the visit was the delivery of a popular lecture on Monday night by Dr. Dugald Clerk, F.R.S., whose subject, "Gas, Oil, and Petrol Engines," was admirably illustrated. On Tuesday there were various meetings of the Council and Committees, and the former body unanimously nominated the Hon. Sir Charles A. Parsons to fill the office of President of the Association for 1917-18, when the meeting will be held at Bournemouth. The appointment of this gentleman, head of the electrical and engineering firm of C. A. Parsons & Co., at Heaton-on-Tyne, and chairman of the Parsons Marine Steam Turbine Co., Ltd., is very pleasing to the district.

The Council also considered a proposal for the constitution of a Committee on organisation in relation to problems arising out of the war. A Committee was appointed, and recommended that the Organising Sectional Committees should meet to consider problems, if any, arising in their special departments of science which might call for investigation in connection with the future effects of the war upon the national and imperial welfare, and the proper methods of investigation of such problems. It was further resolved that a Research Committee should have power to report through the Organising Committees of the Council when the Association was not in session. A number of valuable proposals received from the Organising Sectional Committees had been transmitted to the Council, and action arising out of several of these was proceeding.

The business of the various sections was commenced in earnest on Wednesday morning. In the Engineering Section the President (Mr. Gerald Stoney, F.R.S.) delivered his address, in the course of which he emphasised the importance and value of highly-educated labour in various trades. One of the things which handicapped our industries was the reluctance of employers to utilise such labour. Not only on the scientific side was there much to be done in the way of putting our house in order, there was also

much to be done on the management and commercial side if works were to be put into a position to meet competition effectively. In this section a paper on "Limit Gauges" was read by Dr. R. T. Glazebrook, C.B., F.R.S., in which he dealt with gauges for plain cylindrical work, screw gauges, and form and position gauges. This was the only matter dealt with in this section.

A good deal of interest centred in the Economic Science and Statistics Section, the President of which (Prof. A. W. Kirkaldy, M.A.) spoke upon "Some Thoughts on Reconstruction after the War," in the course of which, after pointing out some of the effects of the war on our economic existence, he dealt with the need for national organisation. Then followed the presentation of a summary of a report on "Means for the Promotion of Industrial Harmony." The report suggested, *inter alia*, that both employers and employed should form local and national associations of one trade, and local and national federations of trades, and the election of an industrial council from the two national associations. The proposals were discussed by Archdeacon Cunningham, Prof. W. R. Scott, Sir Hugh Bell, and Mr. E. Jackson.

In the Chemistry Section, Prof. G. G. Henderson, D.Sc., F.R.S., the President, remarked on the awakening of the country to an appreciation of the importance of chemistry. Mr. F. H. Carr read a paper on "Some Aspects of the Future of the Synthetic Chemical Industry of Great Britain," and Mr. C. M. Whittaker dealt with "The British Coal-Tar Colour Industry in Peace and War."

NOTES.

Institution and Lecture Notes.—Nottingham Society of Engineers.—The first meeting of the 1916-17 session will be held at the Welbeck Hotel, on October 18th, at 7.30 p.m. The Council wishes this meeting to be given to the reading and discussion of short papers on engineering subjects, which should not take more than 10 minutes to read. Six papers will be read by an independent reader, and members will then be asked to vote for the two best papers, so that they can be discussed and prizes awarded. The Council has appointed Mr. J. F. Chambers to the post of secretary, rendered vacant by the resignation of Mr. H. G. Price, his address being The Elms, Daybrook, Nottingham.

Institute of Metals.—The annual autumn meeting will be held on Wednesday, September 20th, commencing at 4 p.m., at Burlington House, London. Sir George T. Beilby will preside, and a number of important metallurgical papers will be presented and discussed.

The Government Research Council having made a grant of £1,000 per annum towards the cost of carrying on the research inaugurated by the Institute into the causes of the corrosion of marine condenser tubes, it has been found possible by the Corrosion Research Committee, which has recently been reconstituted so as to include representatives of all bodies interested in the subject, greatly to extend its sphere of activities. Two salaried investigators have been appointed in the persons of Captain G. D. Bengough, D.Sc., and Dr. O. F. Hudson. They will conduct scientific researches on the Committee's condenser plant now about to be installed, by the courtesy of the Brighton Corporation, in the Brighton Electricity Works. The plant will be worked under ordinary industrial conditions, the microscopical and other examination of the metal treated at Brighton being carried out in the metallurgical laboratories of the Imperial College of Science and Technology, South Kensington.

Fatalities.—Horace Dean Smith (27), of Irlam, an electric stripper crane driver at the Partington Steel and Iron works, Irlam, was struck by an ingot mould, and received fatal injuries, last week; at the inquest a verdict of "Accidental death" was returned.

A young man named George Dixon was killed by electric shock at Hebburn on Wednesday evening, having touched a street-lamp standard with his hand.

An inquest has been held at Manchester into the death of a woman tramway conductor, on a single-deck car, who apparently leaned out of the car to speak to the trolley girl on the rear platform, not noticing a motor wagon which was being overtaken, and got her head crushed between the vehicles. Verdict, "Accidental death."

A verdict of "Accidental death" was returned in the case of George Edward Stitchman, a press driver at the Western Electric Co.'s works, North Woolwich, who was struck by a flying piece of the machine, sustaining concussion and a fractured skull.

An inquest was held at Bilston on Monday respecting the death of a lad named Atkins, at the works of Messrs. Thompson Bros., boilermakers. A witness said he found the lad, a riveter, who had been working at a vice, suffering from shock. He was carried into the stores, and artificial respiration was resorted to, but without avail. Witness explained that before he saw the lad he caught his foot accidentally against a piece of angle-iron, one end of which was on a tank which was to be electrically welded, and the other on the iron leg of the vice. He supposed this must have set up an electric circuit, producing shock, which caused death. Harold Brook, electrical engineer to the power company supplying the current, said the main voltage was 210, but it was transformed to 110 for welding purposes. The jury found that Atkins died from shock caused by an electric current accidentally transmitted.

Volunteer Notes.—First London Engineer Volunteers.—Headquarters, Chester House, Eccleston Place, S.W.—Orders for September, 1916, by Lieut.-Col. C. B. Clay, V.D., Commanding.

Members are requested to take special note that during this month the lectures will be on Wednesdays, in place of Tuesdays.

Drills will be held under the Sergeant-Major on Tuesday evenings, as during August.

The range will be open on Thursday evenings, as during August.

Instruction Classes at Regency Street will be held as usual for Platoons Nos. 9 and 10.

Entrenching.—Every Sunday at Victoria Station (S.E. & C. Railway). Booking-office, 8.45 a.m.

Macleod Yearsley, *Adiutant.*

3rd Batt. (Old Boys') Central London Volunteer Regiment.—Battalion Orders by Capt. R. J. C. Eastwood (Commandant), Thursday, September 7th, 1916:—

Saturday.—The Battalion will Parade at Liverpool Street Station (Low-Level entrance, G.E.R.), at 8.40 a.m., for Entrenching duties. Those who cannot take the early train will parade at 1.20 p.m.

Sunday.—The Battalion will parade at 9.30 a.m. for Entrenching duties.

Bisley Range will be open for practice on Sunday, 10th inst.

The Range will not be open on Saturday, 9th inst.

G. H. F. Duncan, *Acting Adjutant.*

Australian Industrial Inquiry.—On the suggestion of Mr. Herbert Brookes, president of the Victorian Chamber of Manufacturers, the Government proposes to organise a Commission to visit the United States and investigate methods of production and manufacture as well as conditions of employment.

The Commission will consist of six representatives of the manufacturers in Australia, one from each State, with six representatives of the workers, one also from each State. The Chamber of Manufacturers in each capital city will be asked to submit three nominations, and the central Labour organisation in each State similarly to nominate three men. The selection will then be made by the Commonwealth Government.

The following industries are to be investigated by the Commission:—Iron trades, engineering, &c.; timber trades and building material, &c.; leather trades; textile trades; paper trades; trades engaged in the preparation of foodstuffs.

The manufacturers' representatives will be appointed from the several States as follows:—Iron trades—New South Wales; textile trades—Victoria; leather trades—South Australia; trades engaged in the preparation of foodstuffs—Queensland; timber and building material trades—Western Australia; paper trades—Tasmania.

The same principle will apply in the selection of the representatives of the Labour organisations.

A secretary will be appointed, and the Commission will be accompanied by a journalist.

The scheme, says the *Australian Statesman and Mining Standard*, has not met with universal approval; the methods of manufacture are well known in Australia, and Mr. Brookes's recommendation referred more to the study of industrial relations in all industries in actual operation.

Tramways and the Kinematograph.—Our contemporary, the *Electric Railway Journal*, recently contained a sensational view of a car taking a plunge from a viaduct spanning a ravine. The explanation given was that a moving picture firm bought up a discarded car from the Ithaca Traction Corporation, using it for picture making; as the plot developed, the villain (represented by a dummy), having been knocked out by the hero, was left on the front platform of the car, which, after gathering speed on a grade, was derailed by a switch on the viaduct, breaking through the imitation railings and falling some 300 ft. to the bottom of the gorge. The car is said to have landed head-on in the bottom, and a good many tramway men will, no doubt, be interested to view the remains.

A Novel Gas Turbine.—A recent issue of *Power* contained a brief description of a gas turbine introduced by the Detroit Gas Turbine Corporation. Its principle of operation consists in compressing a charge of the mixture, firing it at constant volume in an explosion chamber, which results in a very high pressure, and allowing the products of combustion to impinge on a series of moving and stationary blades. The arrangement shown consists of eight radial gas compressor cylinders, which compress the gas mixture to about 90 lb. per sq. in. prior to its discharge into firing chambers round the periphery of the turbine, from which the products of combustion at high pressure impinge on two rows of moving blades separated by a row of stationary blades. The moving blades are carried on the outer casing which revolves about the driving shaft on ball bearings, and is geared to the shaft through a 3 to 1 reduction giving a shaft speed of 3,000 R.P.M., which corresponds to 24,000 explosions a minute. The rotor diameter for a 200-H.P. turbine is said to be 21 in., and the weight 335 lb.

Appointments Vacant.—Assistant master in electrical engineering for the Polytechnic, Regent Street, W.; shift engineer for Neath R.D.C.; two electricians (£22 10s. p.m.) for Rhodesia; mains attendant (£2) for Leek U.D.C. See our advertisement pages to-day.

Educational Notes. — Royal Technical College, Glasgow.—We have received the College Calendar for 1916-17, giving particulars of the various engineering courses. Prof. Magnus Maclean is at the head of the Electrical Engineering Department.

West Ham Municipal Technical Institute.—The new session commences on September 20th; day and evening courses in electrical engineering are provided. Particulars are given in our advertisement pages to-day.

Goldsmiths' College (University of London), New Cross, S.E.—The new session begins on September 25th. Mr. W. J. Lineham is at the head of the engineering department. See our advertisement pages to-day.

Field Operating Theatre.—A motor field operating theatre, which is about to be presented to the Italian Government by the Wounded Allies' Relief Committee, has been on view in the grounds of Aldford House, Park Lane, London, W. The electrical installation includes three 100-c.p. lamps and other smaller lamps in the interior of the theatre, together with two electric fans, and on the outside Blériot head lamps, side lamps, and tail lamp. The current is supplied by a Blériot 12-volt, 200-watt dynamo, which is driven by the engine, and gives 15 amperes when the vehicle is running at 12 miles an hour and 25 amperes when stationary. The construction has been carried out under the supervision of Mr. J. N. Walford.

Copper.—The figures for copper supplies, as shown in Messrs. H. R. Merton & Co.'s circular, are of an encouraging nature. While the price at the end of July, 1916, was £111 per ton (standard copper), it is shown for the end of August to be £109 10s. While it has been impossible to estimate the stocks in Rotterdam, Hamburg and Bremen, and no figure can be given for American stocks, the supplies usually known as "European visible supplies" stand at a very healthy figure. The total supplies for the month of August, 1916, were 43,239 tons, which compares most favourably with August, 1915 (30,518 tons), and, of course, with August, 1914 (25,429 tons), and even shows up fairly well against the average for the 12 months preceding the war (47,740 tons). Taking the quantities under their various headings, we find that the European arrivals from North America were 25,367 tons, about ⅓rd less than the pre-war average; those from Spain and Portugal to England and France low (following an unusually high delivery in July). "Other countries" gave double the pre-war average; Chile shipments were more than ⅓rd higher, and Australian about ⅓rd below. The supplies for last month have only three times been exceeded since August, 1914, *i.e.*, in March, 1915 (43,272), May, 1915 (46,032), and June, 1916 (44,526).

Norwegian Copper Exports.—The export of copper, copper ores, and pyrites from Norway was prohibited from Tuesday last. This measure has been adopted in order to secure the retention of some 3,000 tons of manufactured copper required in connection with electric works and street railways which has been obtained from America. At the same time it is understood that concessions will be made for export to the belligerent countries against compensations for the same quantity of manufactured copper to neutrals.

"Cold Light" Again.—The daily Press, forgetting that the fallacy was exposed by us some years ago, and unable to discriminate for itself between fact and fiction, has once more got hold of the "cold light" system of Prof. Dussaud, and is treating it as a novelty. The essence of the system is to spin a number of electric lamps on a wheel, each lamp being energised in turn for a fraction of a revolution, so as to give the impression that the light is continuous. As the heat developed whilst the lamp is burning is dissipated whilst it is out, the lamps remain cool—hence the term, "cold light." It is merely a roundabout and elaborate way of obtaining the same result as would be secured by burning one lamp and keeping it cool with a water-jacket or a fan. Whatever advantages are claimed for the Dussaud system can be far more easily and cheaply obtained by other means.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—Mr. S. W. Carty, late of the electrical department of the Liverpool Corporation tramways, has been gazetted to a captaincy. He has recently returned from the Soudan, and the following is an extract from a recent letter which Mr. J. H. C. Brooking has kindly sent us:—"As you know, I went to Egypt last February, and first week in April I was sent in charge of a detachment of lorries and men to the Soudan to take over the transport of supplies, &c., of the Western Frontier Force, who were operating against the Sultan of Darfur. It was over 2,000 miles south of Alexandria, and we went by rail to Assouan (Shallal) and then down the Nile on barges to Wadi Halfa, and on by Kitchener's Railway over the desert to Khartoum, and thence again by rail to El Obeid (Kordofan). From there I trekked due west 200 miles over sand, desert, and through the bush, where nothing but camels had ever been before, and safely carried supplies, going backwards and forwards from the railway at El Obeid. Of course, there was no road, only a track; it was some job, as we had all sorts of stores to take, oil, petrol, bombs, spare engines and parts for the Flying Corps, telegraph poles, boxes of stuff all manner of kinds. Darfur lies between French Equatorial Africa and Kordofan (British Territory). As you know by the papers, the Sultan's army was beaten and dispersed, and he fled, so we have taken over the country. I got specially thanked by the Sirdar (General Sir Reginald Wingate), who is Kitchener's successor in the Soudan."

Phillip Yellowlees, who was employed as an electrician on H.M.S. *Nottingham*, was three hours in the water when that ship sank before being picked up. Prior to joining the Navy, Yellowlees was in the employment of the Electric Supply Co., Jedburgh.

The Aylesbury U.D.C. has appointed Mr. Mark Whittle, of Horwich (Lancs.), as assistant electrical engineer, subject to his being exempted from military service.

Mr. D. H. Davies, chief electrical assistant at the Stockton Corporation undertaking, has been appointed electrical engineer and tramway manager to the Heywood Corporation at a salary of £200 per annum. There were 50 applicants for the post.

General.—Mr. E. J. Fox is resigning the position of London manager of Messrs. Stewarts & Lloyds, Ltd., in order to take up the position of general manager of the Stanton Iron Works Co., Ltd., near Nottingham, with a seat on the board as managing director. Mr. Fox succeeds in March next Mr. J. A. Longden, whose services will, however, be available to the company, as he remains a member of the board of directors.

Mr. C. F. Ashby, district manager of telephones at Canterbury, has been promoted to an important position at Norwich, and will be succeeded by Mr. Maclean, of Plymouth.

We learn that Mr. Egron Moller, of the Allmänna Svenska Elektriska Aktiebolag, of Vesteras, has arrived in London to organise the manufacture of transformers in England by the Swedish General Electric, Ltd.

Mr. J. N. Stephens (manager of the wiring supplies department of the British Thomson-Houston Co.) has joined the Royal Flying Corps as Second-Lieutenant (Assistant Equipment Officer).

Roll of Honour.—Last week we mentioned that Captain H. C. Sparks had received the D.S.O. for conspicuous gallantry; we are pleased to add that the French Government has awarded him the "Croix de Guerre" with palm leaf (which, we understand, is a special honour), for the same action on July 1st. Captain Sparks was awarded the Military Cross in June last.

Driver W. Owens, accidentally killed whilst on active service, was assistant storekeeper, and Rifleman W. Bradley, killed in action, was a warehouseman, with Messrs. Downes and Davies, electrical engineers, of Liverpool.

Private Richard Massey, who was formerly employed with the Electrical Apparatus Co., Ltd., has been killed at the Front. He was only 19 years old, and was one of the first members of the Corpus Christi School Volunteer Training Corps.

Lieutenant F. G. Duncan Stoney, R.E., who has died from wounds, was the only son of the late E. D. Stoney, and was on the staff of Messrs. Ransomes & Rapier, Ipswich, when war broke out. His commanding officer wrote that he would be very very difficult to replace, not so much on technical grounds, though he was the best educated scientifically of any of the officers in the Division, but because of his many-sided nature. The General also expressed his personal sorrow and appreciation of his ability, and a further letter of appreciation was written by the N.C.O.'s and men of his section.

Private C. Cashmore, Oxford and Bucks L.I., who was with the British Thomson-Houston Co., is reported killed in action.

Private Arthur N. Henderson, King's (Liverpool) Regiment, who was with Messrs. Pulford Bros., Ltd., electrical engineers, Liverpool, has died from injuries received while engaged with a bombing party.

Gunner F. Goodman, R.F.A., who has died of wounds, was formerly employed by the British Thomson-Houston Co.

The Military Medal has been awarded to Private Charles Smith, formerly a tramway conductor with the Bradford Corporation.

The *Calcutta Weekly Statesman* records the death in action of Mr. Jogendra Nath Sen, B.Sc. Mr. Sen left India in 1910, gained admittance to Leeds University, and after taking an engineering course for three years, graduated as a Bachelor of Science. Soon afterwards he secured a position under the manager of the Leeds Corporation electric lighting station, and was ultimately placed on the staff as an assistant engineer. On the outbreak of hostilities with Germany Mr. Sen joined the West Yorkshire Regiment.

Lance-Corporal John Henry Andrews, Manchester Regiment, formerly with the British Westinghouse Co., is a prisoner of war at Dulmen, Westphalia.

Private Arthur Webb, Manchester Regiment, a former employé of Messrs. Baxendale & Co., Ltd., is missing.

Corporal William Harley, Rifle Brigade, aged 19 years, who has received the Military Medal, was employed in the Manchester Corporation Tramways Department.

Sergeant J. Neary, of the East Lancashire Regiment, who has been awarded the Military Medal for conspicuous bravery, was an employé of the Salford Tramways Committee.

Private Albert Edge, of the Canadian Contingent, killed in action at the age of 23, was a Swinton (Lancs.) man, engaged as an electrician in Canada.

Lieutenant James Duncan Simpson, Canadian Royal Engineers, killed in action, was educated in Scotland, and trained as an electrical engineer with Messrs. Mavor & Coulson.

Captain J. A. Rutherford, killed in action, was before the war on the staff of the Rangoon Electric Tramway & Supply Co.

We note that a recent casualty list contained the name of Lieutenant Ziani de Ferranti, R.G.A., as being wounded.

Mechanic Staff-Sergeant Thomas Michael Walton, who has been awarded the Albert Medal (second class) was formerly employed by the Cleveland and Durham Electric Supply Co. The award is for gallantry in saving life.

Rifleman James Parsonage, 25 years of age, formerly employed by the St. Helens Cable & Rubber Co., Ltd., has died of wounds.

Private H. Goodeve, Manchester Regiment, who has died of fever in Mesopotamia, was with the Guildford Electricity Co. He was wounded in the retreat from Mons, and in November, 1915, was drafted to Mesopotamia.

Private Clifford Morris, Cameron Highlanders, of Middleton (Lancs.), who was an electrical apprentice, has been killed in action.

Private Richard Pontefract, Manchester Regiment, formerly employed at the Chloride Electrical Storage Co.'s works, has died from wounds.

Rifleman Ernest Grant, Rifle Brigade, formerly with Messrs. Willans & Robinson, has fallen in action.

Privates Ernest Bibby and F. E. Small, Somerset Regiment, formerly with the Weston-super-Mare Electric Supply Co., Ltd., are reported killed, the latter from poison gas; both men joined up at the start.

Lance-Corporal J. H. Purton, Oxford and Bucks Light Infantry, who has died of wounds, was formerly with the British Thomson-Houston Co., Ltd.

Driver Alec Mackmin, Sussex Yeomanry, formerly an electrician at Croydon, has died of wounds received in Gallipoli.

Private Jas. Park, Seaforth Highlanders, killed in action, was formerly an electrician at Workington.

Private W. H. Hewitt, Manchester Regiment, formerly with Messrs. Mather & Platt, Ltd., is posted as missing.

Private Wilfred Mayers, of the King's (Liverpool) Regiment, who was employed by Messrs. F. J. Jones & Sons, electrical engineers, Chester, has been wounded.

Lance-Corporal Harry Wood, Loyal North Lancashire Regiment, who has died of wounds, was in the Bolton Corporation Tramways Department.

Rifleman S. Chafer, West Yorkshire Regiment, and Company Sergeant-Major P. B. Symes, Northumberland Fusiliers, who have been killed, were both employed on the Leeds tramways.

Private Norman Scott, who has been awarded the Military Medal, was formerly in the wireless department of Messrs. Eaton & Co., of Toronto.

Will.—Under the will of Mr. F. C. Kennedy, C.I.E., director, Burmah Electric Tramways & Lighting Co., and other companies, personal estate in the United Kingdom of the gross value of £248,258 was left.

NEW COMPANIES REGISTERED.

Steel's Electric & Engineering Co., Ltd. (144,669).—This company was registered on August 23rd, with a capital of £3,000 in £1 shares, to take over the business carried on at 206, East India Dock Road, E., as Steel Bros., and to carry on the business of electricians, electrical and mechanical engineers, contractors and manufacturers of, and dealers in, all apparatus used in connection with the generation, distribution, supply, accumulation, and employment of electricity, steam, gas, oil, or other power, manufacturers and repairers of, and dealers in, motor-cars, &c. The subscribers (with one share each) are: E. Lee, 3, Clyde Wharf, Victoria Docks, E., marine engineer; S. F. Hastings, 41, Bulstrode Avenue, Hounslow, W., civil engineer. Private company. Table "A" mainly applies. Secretary (*pro tem.*): E. Lee. Registered office: 206, East India Dock Road, E.

Hadon, Ltd. (144,685).—This company was registered on August 25th, with a capital of £500 in £1 shares, to take over an invention for electrically-operated clocks, to carry on the business of clock manufacturers, dealers and importers, &c., and to enter into an agreement with W. Alldis. The subscribers (with one share each) are: F. C. Dixon, 1, Lancaster Place, Strand, W.C., solicitor; J. H. Dixon, 1, Lancaster Place, Strand, W.C., solicitor. Private company. Table "A" mainly applies. Solicitors: Dixon, Weld & Co., 1, Lancaster Place, Strand, W.C.

Aluminium Solder Co., Ltd. (144,725).—This company was registered on August 30th, with a capital of £150 in £1 shares, to take over the business of manufacturers of aluminium and other solders, dealers in metals and alloys and products thereof, and general dealers in metals and hardware, carried on by W. H. M. Burgess, A. Lees, and H. F. Galpin, jun., as the Aluminium Solder Co. The subscribers (with one share each) are: W. H. M. Burgess, 40, Glasshouse Street, W., engineer; A. Lees, Fairford, Glos., engineer; H. F. Galpin, jun., Oxford, solicitor. Private company. The number of directors is not to be less than two or more than five. The first are W. H. M. Burgess, A. Lees, and H. F. Galpin, jun. Qualification, one share. Solicitor: H. F. Galpin, jun. Registered office: 40, Glasshouse Street, Piccadilly, W.

International M. P. Superheater Co., Ltd. (144,687).—Registered August 25th, by G. S. Warmington & Edmonds, 14-15, Coleman Street, E.C. Capital, £400,000 in £1 shares. Objects: To acquire any patents, rights, brevets d'invention, licences, protections, and concessions relating to the manufacture or construction of superheaters, locomotives, engines, or other similar apparatus, to carry on the business of engineers, founders, machinists, manufacturers of superheaters, or other apparatus for heating water or air, locomotives, engines, tool makers, metal workers, boiler makers, millwrights, iron and steel converters, woodworkers, builders, painters, metallurgists, electrical and water supply engineers, gas makers and merchants, &c., and to adopt an agreement with Miecislas Pokrzywnicki. The signatories (with one share each) are: D. J. Edmonds, 14-15, Coleman Street, E.C., solicitor; W. H. E. Godolphin, 14-15, Coleman Street, E.C., clerk; W. Lewis, 14-15, Coleman Street, E.C., mining agent; H. Chitty, 27, King Edward's Gardens, Acton Hill, W., engineer; W. F. H. Jeffes, 15, Rue d'Edinbourg, Brussels (33, Carlingford Road, Hampstead, *pro tem.*), barrister; W. L. Griffith, 50, Parliament Street, S.W., architect; T. G. W. Parry, 17, Coleman Street, E.C., financial agent. Minimum cash subscription, seven shares. The first directors are Pol Mouton and E. Petersson. Qualification, £500. Remuneration, £200 each per annum (chairman £300), and a percentage of the profits. Registered office: 14-15, Coleman Street, E.C.

Fellows Magneto Co., Ltd. (144,665).—Registered August 23rd, by Herbert Smith, Goss, King & Gregory, 62, London Wall, E.C. Capital, £75,000 in 50,000 pref. shares of £1 each and 50,000 ord. shares of 10s. each. Objects: To carry on the business of manufacturers and repairers of, and dealers in, machinery and plant, tools, appliances, and engines of all kinds, motor-cars, vans, cycles, airships, aeroplanes, aircraft, boats, vessels, ships, and conveyances for transport of persons or goods, whether on land, sea, or in the air, dynamos, magnetos, accumulators, coils, carburettors, speedometers, taximeters, and accessories and component parts of automobiles, and all other machines and vehicles, motor electricians, ignition specialists, mechanical and electrical engineers, machinists, iron, steel, brass, and other metal founders, &c., and to adopt an agreement with Fellows & Co. The signatories (with one share each) are: E. J. Burrows, 29, Lyndhurst Road, Highams Park, Chingford, clerk; H. J. Palmer, 157, Offord Road, Barnsbury, N., messenger; Margherita Newport, 39, Holsworthy Square, W.C., clerk; F. Mitchener, 37, Fontenoy Road, Balham, S.W., clerk; F. H. King, 62, London Wall, E.C., solicitor; W. A. Bewes, 2, Harcourt Buildings, Temple, E.C., barrister; J. Barnes, 7, Walcot Gardens, Kennington, S.E., accountant. Minimum cash subscription, seven shares. The first directors (to number not less than two or more than seven) are V. L. Fellows, D. V. L. Fellows, S. L. Fellows, and H. M. Alleyn (vendors to the company). Qualification (except above-named directors), £500. Remuneration, £200 each per annum (chairman £100 extra). Registered office: Cumberland Avenue, Park Royal, Willesden.

Faraday & Son, Ltd. (144,736).—This company was registered on August 31st, with a capital of £5,000 in £1 shares, to adopt an agreement with Rosa B. Faraday, P. Faraday, and L. B. Faraday, to carry on the business of electrical engineers and manufacturers of electrical fittings as formerly carried on by the said vendors at 146-150, Wardour Street, W., as Faraday & Son. The subscribers (with one share each) are: P. Faraday, 146-150, Wardour Street, W., manufacturer of electrical fittings; L. B. Faraday, 146-150, Wardour Street, W., manufacturer of electrical fittings. Private company. The number of directors is not to be less than two or more than five; the first are P. Faraday and L. B. Faraday (both permanent, special qualification, one share). Qualification of ordinary directors, 500 shares. Remuneration (except managing director) as fixed by the company. Solicitors: Redpath, Marshall & Holdsworth, 23, Bush Lane, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Hans Renold, Ltd.—A memorandum of satisfaction in full on August 10th, 1916, of charge dated October 14th, 1915, securing not more than £100,000, has been filed.

Brilliant Arc Lamp & Engineering Co., Ltd.—Particulars of £2,500 debentures, created August 9th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Faringdon Electric Light & Power Co., Ltd.—Particulars of £300 debentures, created June 30th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Ilford Dry Battery Co., Ltd.—Particulars of £1,250 debentures, created August 23rd, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Suffolk Electricity Supply Co., Ltd.—Issue on July 26th of £1,000 debentures, part of a series of which particulars have already been filed

CITY NOTES.

Kalgoorlie Electric Tramways, Ltd.

The report of the directors and statement of accounts at December 31st, 1915, shows that the gross receipts amounted to £33,526, against £31,891 for the previous year, whilst the net profits earned, before charging depreciation, were £7,205, against £7,265, the increased receipts being entirely absorbed by the extra expenses incurred in improving the service in order to compete with the motor-car traffic and in the additional cost of operating and maintaining the tramway. There was no improvement in the business conditions of Kalgoorlie during the past year, and the tramway is still subject to competition from the motor cars. The necessity of providing for depreciation by means of a fund for the renewal of the plant, cars, &c., has for a long time past been before the directors, but the commitments of the company for interest and sinking fund have absorbed the whole of the available profits from time to time, and it has consequently been impossible to provide such a fund. The "A" stockholders passed a resolution on June 7th, 1915, by which the company was released from

the obligation to provide a fixed sum of £9,000 per annum, and a provision that the net profits of the company up to £9,000 per annum should be set aside for the service of the interest and sinking fund was substituted. Before arriving at net profits the directors are of opinion that some provision must be made towards the expenditure referred to, and they have therefore set aside £4,000 for this purpose. During the year the tramcars travelled 593,434 car miles, as against 582,114 car miles in the year 1914, and carried 2,192,135 passengers, as against 2,125,094 in the year 1914. The earnings per car mile in 1915 were 13.52d., as against 13.12d. in 1914, with an expense of 9.93d. per car mile, as against 9.48d. in 1914. The number of units consumed in 1915 were 692,935 (£7,939), as against 632,165 (£7,242) for the year 1914. During the past year the whole of the Boulder Road has been re-made between Kalgoorlie and Boulder, and this, in conjunction with the heavy motor-car traffic, has given very bad tracks for quick services, and increased power consumption. The "A" debenture stock has been further reduced by the sum of £1,800, and the amount of stock outstanding at the date of the accounts was £48,000.

At the annual general meeting the Chairman, in moving the adoption of the report and accounts, said that the profits of the undertaking were still very small. The competition of motor-cars still continued, and it was of a most unfair character, because the tramway company was compelled to run a continuous service for the benefit of the town, whereas the motor-cars did just whatever they pleased, running whenever there was a chance of getting good traffic. It was probable that the scarcity of petroleum would do away with that form of competition, but it was doubtful whether they would receive any great benefit, so many low-grade mines had had to close down and so many miners had joined the fighting forces and left Kalgoorlie. For the moment the only thing they could do was to go quietly on and hope for the best. The first debentures had certainly been reduced to £48,000, but behind those came the second debentures, and unless some miraculous change took place there seemed very little probability of anything ever coming to the shareholders. The high cost of labour was against both mining and agricultural development, and it was doubtful whether the Transcontinental Railway would bring the benefits anticipated to the town.

The report was unanimously adopted, and the retiring director, Mr. C. C. Baker, re-elected.

Manila Electric Railroad and Lighting Corporation.

The report for the twelve months ended December 31st last states that the gross earnings of the companies for the year were $1,494,787, a decrease from the previous year of $107,213, or 6.69 per cent.; operating expenses and taxes, $762,958, a decrease of $55,455, or 6.78 per cent.; while the net earnings from operation were $731,828, a decrease of $51,757, or 6.60 per cent. Interest charges during the year were $264,975, and sinking fund requirements were $41,500, leaving a surplus for the year of $425,353. The directors maintained the annual appropriation for the replacement and renewal fund of $80,000, and, deducting this from the year's surplus earnings, there remains an available surplus for the year of $345,353. From this amount there were paid four dividends of 1¼ per cent., making 6 per cent. for the year, aggregating $300,000, leaving $45,353 over all disbursements and reserves, which was transferred to surplus account, making total accumulated surplus to December 31st last $1,778,835. Against this amount was charged $55,000 to provide for a special reserve recommended by the company's auditors, leaving total accumulated surplus and reserves, as per balance sheet, of $1,723,835. In the railway department the earnings decreased $107,801 and the operating expenses increased $5,045; in the electrical department the earnings increased $22,138 and the operating expenses decreased $42,568. In the other departments the earnings decreased $21,550 and the operating expenses decreased $29,343. Almost all the local industries and business houses followed a policy of retrenchment, which caused decreased revenues to the insular and municipal treasuries, which, in turn, had to resort to the assessment of additional taxes. During the year there were purchased under the sinking fund provisions of the company's mortgage $37,000 face amount of the 5 per cent. 50-year first lien and collateral trust sinking fund gold bonds, making a total of $255,000 face value of bonds held by the trustee. There were also purchased under the sinking fund provisions of the mortgage of the Manila Suburban Railways Co. $5,000 face value of the first mortgage 5 per cent. 40-year sinking fund gold bonds of that company, making a total of $19,000 face value of bonds held by its trustee.—*Financier.*

Brazilian Traction, Light and Power Co.

The report for the year ended December 31st (as given in the *Financial Times*) states that while the combined earnings of the companies in Brazilian currency have fully realised the expectation of the board, being considerably greater than those of the previous years, the result is not so satisfactory when such earnings are converted into Canadian currency. Converting the earnings during 1915 at the average rates prevailing prior to the war, the net revenue in Canadian currency would be increased by over $3,000,000. The revenue of the company in Canadian currency resulting from the year's operation was as follows:—Revenue from securities owned and under contracts with subsidiary companies $5,339,192, and from interest on advances to subsidiary companies $273,683, a total of $5,612,876. Deducting general and legal expenses, administration charges, and interest on loans, amounting to $218,074, and the dividends paid on the preference and ordinary shares, there remains a surplus carried forward of $545,421. During the first half of 1915, dividends on the ordinary shares at the rate of 1½ per cent. each were paid on March 1st and June 1st respectively. As, however, contrary to expectations, the exchange value of the milreis continued to fall, the board decided to limit the dividends payable on September 1st and December 1st to ½ of 1 per cent. each, making a total dividend of 4 per cent. for the year. Although rigid economies have been effected, the cost of operation and maintenance has been adversely influenced by the rise in the price of materials and by the enormous advance in ocean freights. This advance has particularly affected the earnings of the gas business, as owing to the requisition by the British Government of some of the steamers employed in the company's service for carrying coal, it became necessary to charter other steamers at rates greatly exceeding those which would have been payable under normal conditions. It is, therefore, remarkable that, notwithstanding the adverse circumstances, the results for the year have been so satisfactory, and with a return to normal conditions the revenue should be not only equal to that obtained prior to the war, but should show a considerable and steady increase. Conditions generally in Brazil are showing distinct signs of improvement. During the year further shares have been acquired in the Companhia Telephonica do Estado de Sao Paulo and in the Companhia Rede Telephonica Bragantina, and with those subsequently purchased this company now holds 95 per cent. of the share capital of each company. This company has also made advances for the purpose of carrying out necessary improvements and extensions to the telephone systems, which, when completed, should result in material increases in the revenue. A quarterly dividend of 1½ per cent. has been declared on the preference shares, payable October 2nd, to shareholders of record of 15th inst.

Consolidated Gas, Electric Light & Power Co., of Baltimore.

The report for the year ended June 30th states that the gross income amounted to $7,431,768, and the operating expenses and taxes to $3,848,076, leaving net earnings of $3,583,692; fixed charges absorbed $1,580,057, and dividends paid and payable $1,131,803, leaving $871,831, out of which there has been placed to reserve for depreciation, amortisation, &c., $550,000, to reserve for contingencies $134,541, and charged off to bond discount $90,000, leaving a net surplus of $97,289. The growth in the sale of both gas and electricity has been phenomenal, and the increase in the sale of electricity has broken all previous records. The gross income from sale of electricity was $3,881,665, against $3,301,199 in 1915, an increase of $580,466, while the electricity sold, KW.-hours, was 183,475,608, against 126,933,209 in 1915, an increase of 56,542,398. The power sales department is negotiating for power installations aggregating 60,000 H.P. The company is now completing the installation of a steam turbine of 27,000 H.P. as an addition to its steam generating station. On May 1st last the properties of the Patapsco Electric & Manufacturing Co. were formally taken over.

Stock Exchange Notice.—The Committee has been asked to allow the following to be quoted in the Official List:—

Mexican Electric Light Co., Ltd.—Deposit receipts for 5 per cent. first mortgage gold bonds.

Mexican Light & Power Co., Ltd.—Deposit receipts for 5 per cent. first mortgage gold bonds and 5 per cent. second mortgage 50-year bonds.

Mexico Tramways Co.—Deposit receipts for general consolidated first mortgage 50-year 5 per cent. gold bonds and 6 per cent. 50-year mortgage bonds.

Pachuca Light & Power Co.—Deposit receipts for 5 per cent. first mortgage 50-year bonds.

Underground Electric Railways Co. of London, Ltd.—£15,000 additional 6 per cent. income bonds.

Amalgamated Wireless (Australia) Co.—The report for the half-year ended December 31st states that the business has been interfered with by the war. There are 85 subsidy ships, and the manufacturing department and training school are doing good work. The net profit amounts to £2,230, which, with £1,102 brought forward, makes available £3,332, which is to be carried forward. The radio-telegraphic traffic for the half-year and subsidies amounted to £11,045, and other gross profits to £912. The share capital is £140,000, and reserve funds £14,112.—*Commonwealth Engineer.*

Shawinigan Water & Power Co.—A dividend of 1¾ per cent. for the quarter ended 30th inst. on the common shares, payable October 10th to shareholders of record 30th inst., has been declared.

Bolckow, Vaughan & Co.—The directors have decided to pay to the ordinary shareholders a further dividend of 8 per cent., less tax, in addition to the interim dividend paid in March last.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—The directors announce an interim dividend of 2½ per cent. on the ordinary shares, payable 29th inst., less tax.

STOCKS AND SHARES.

Tuesday Evening.

Markets have been in very cheerful fettle, the excellent news from the various Fronts assisting the sentiment, although during the early part of the week they were quite eclipsed by the general delight over the burning of the Zeppelin. In the air there is vague talk of peace, the proposals for which, be it carefully noted, are to come from the other side. People are laying their plans, financial and otherwise, for what is going to happen upon the conclusion of the war; and one man in the Stock Exchange, carried away by the fervour of the moment, exclaimed that these are already peace markets. Nor did he find much strenuous denial, though the statement aroused good-humoured banter.

Home Railway stocks are once more in a better position. Considerable buying of the low-priced issues is something of a feature. Metropolitans participated in this, and rose 1¼. Districts hardened to 19, though the price failed to keep the improvement. The chief centre of interest is Brighton deferred, which has its electrified system, as well as its prospects of improved business after the war, to attract investment attention.

South-Western deferred, too, which has been languishing in neglect for some time past, rose a point to 26, at which the immediate yield on the money, assuming the dividend for this year to be the same as that in 1915, comes out to nearly 6 per cent. The Home Railway market generally is good. Whether it will remain so depends solely upon the continuance of demand; we have too often seen strength in this section succeeded by prompt return to dullness for the observer to place much reliance upon a display of improvement.

The Brazilian Traction, Light & Power Co. has issued its third annual report, for the year ended December 31st, 1915. The company, of course, draws its revenue from three subsidiaries, the Rio de Janeiro Tramway, the Sao Paulo Tramway, and the Sao Paulo Electric Companies. From the earnings point of view, the company flourished finely; but in the course of conversion the gross receipts of 8 million dollars fell to 5¼ million dollars. Each division of the company contributed improvement to the profit and loss account; and if it had not been for the fall in the milreis, the results would have been excellent. As it is, however, the company is paying 4 per cent.; and unless the exchange rises, there seems to be little chance of this rate being increased. The price of the shares fell a point to 61¼.

Mexicans, on the other hand, are firmer, with the exception of the common shares of the Mexican Light & Power Co., which have eased off to 19. The company's 5 per cent. first bonds have advanced to 43, the rise being shared by the similar bonds of the Mexico Tramways.

A meeting of Mexican Light & Power bondholders is to be held on October 5th, at which it is to be proposed that prior lien bonds should be created, to rank ahead of the present bonds as regards principal and interest; while it is further proposed that the directors shall be allowed to waive all payments of dividends due, or falling due, for such time as they shall think fit. Holders of the bonds should make it their business to attend the meeting next month, and, pending further details, to withhold their support from one side or the other.

The experience of some of the other utility companies in Mexico, Brazil, and the United States has not been generally flattering to the holders of the bonds, in those cases, of course, where prior lien issues have been sanctioned and made; and proprietors of Mexican Light & Power bonds, bearing this in mind, will be well advised to preserve an open mind at present. At the same time, there is no getting away from the unfortunate fact that most Mexican companies affected by the rebellion of the past three years must be in want of money, and that there is very little chance of the British Treasury permitting the issue of fresh capital while the war is in progress. Truly the position is a difficult one, and it is hard to know what to do for the best.

Gains have been secured by the British Columbia Electric Railway stocks, the preference putting on 3 points to 70, and the deferred at 51 showing a gain of a point. The tramway section is firm as a whole. Brisbane Electric Investment ordinary rose to 6¼, and the preference are better at 4¼.

Electric shares have quietly improved. Several of them were quoted ex dividend last Thursday, and in some cases the deductions, or part of them, have been regained. Westminsters rose to 6¼. Metropolitans are 5s. up at 2¾. South Metropolitans are a good spot, with buyers about at 19s. The preference are steady at 22s. ex dividend. General Electric ordinary have risen to 13¾, the preference retaining their rise of last week at £10. Edison & Swan 5 per cent. debenture stock at 62½ is 2½ up, and the tone of the miscellaneous market is strong throughout.

British Insulated ordinary put on 5s. at 12¼. Callenders at the same price are a similar amount better. India-Rubbers at 12¼ are another ⅛ to the good; and Henleys at 6¾ have not only recovered their dividend of 5s., but have added an equal amount to it. The rises are genuine in every case; and, as we have noted before, the demand outstrips the supply.

Eastern Telegraph ordinary at 149 is a little harder, but the other issues in this group show no change. New York Telephone 4½ per cents. are par. Orientals are a feature of strength, a rise of 3/16 taking the shares to 2¼, at which the return on the money looks so slender that the expectations of an increase in the dividend appear to have good ground. Indo-Europeans rose £1 to 49, but Great Northerns, after their jump of last week, reacted 10s. to 42.

The feature of the Marconi market is the strength of Americans, the price touching 20s. This was in part a reflection of the recovery in American rails brought about by the reported settlement of the threatening coal strike, which this time last week looked as though it were going to plunge industrial America into something approaching chaos. Marconis themselves are a shade easier at 3 3/16; and there is nothing much doing in Canadians, the price remaining at half-a-guinea. The Anglo-American stocks and shares are steady, and there is no change in either class of Globe Telegraph and Trust.

The rubber section keeps very strong, and the price of the raw material revolves around 2s. 3d. per lb. The autumn dividends are expected to be uniformly good, and the early arrivals foster this impression. There is pronounced strength in the iron, coal, and steel list. Copper shares are somewhat heavy. Buyers predominate in the armament group, and, generally speaking, the industrial market is one of the most active in the Stock Exchange.

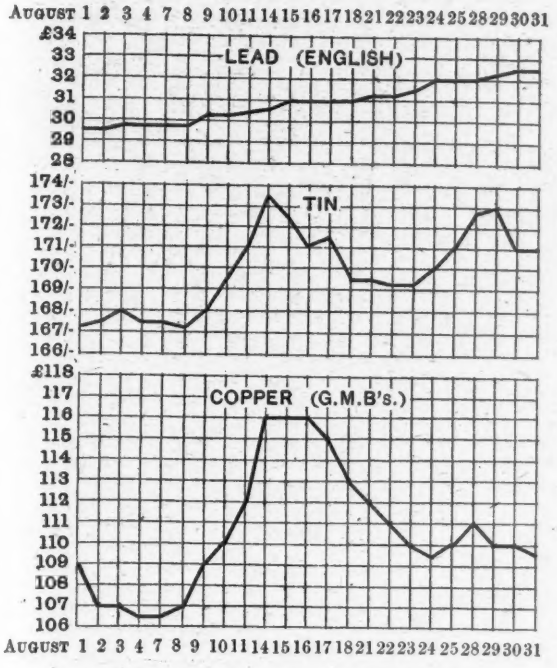
SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1914.	Dividend 1915.	Price Sept. 5, 1916.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	10	6⅜	—	£7 18 2
Charing Cross Ordinary	5	5	3⅜	+ ⅛	6 18 0
do. do. do. 4½ Pref.	4½	4½	5⅜	—	6 8 7
Chelsea	5	4	3	—	6 18 4
City of London	9	8	13½xd	—	6 10 8
do. do. 6 per cent. Pref.	6	6	10½xd	—	5 17 1
County of London	7	7	11	—	6 7 3
do. 6 per cent. Pref.	6	6	10⅜	—	5 18 0
Kensington Ordinary	9	7	5½	—	6 7 3
London Electric	4	3	1⅜	—	6 10 5
do. do. 6 per cent. Pref.	6	6	4⅜xd	—	6 13 4
Metropolitan	3½	3	2⅞	+ ½	5 9 1
do. 4½ per cent. Pref.	4½	4½	3½	—	7 4 0
St. James' and Pall Mall	10	8	6¼	—	6 8 0
South London	5	5	2¼	—	8 18 10
South Metropolitan Pref.	7	7	1⅞	—	6 7 3
Westminster Ordinary	9	7	6½	+ ⅛	5 12 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	103½	—	5 16 0
do. Def.	30/-	33/6	23½	—	7 8 9
Chile Telephone	8	8	7	—	5 14 5
Cuba Sub. Ord.	5	5	8½	—	6 8 6
Eastern Extension	7	8	11⅛	—	*5 7 6
Eastern Tel. Ord.	7	8	149	+1	*5 7 5
Globe Tel. and T. Ord.	6	7	12¼	—	*5 8 8
do. Pref.	6	6	10⅝	—	5 10 4
Great Northern Tel.	22	22	42	— ½	5 4 9
Indo-European	13	13	49	+1	6 12 8
Marconi	10	10	3 3/16	— 1/16	3 2 9
New York Tel. 4½	4½	4½	100	+ ¼	4 10 0
Oriental Telephone Ord.	10	10	2¼	+ 7/16	4 8 11
United R. Plate Tel.	8	8	6¼	—	*5 16 5
West India and Pan.	1	—	1 1/16	—	—
Western Telegraph	7	8	15	—	*5 6 8
Home Rails.					
Central London, Ord. Assented	4	4	74	—	5 8 1
Metropolitan	1½	1	25⅞	+1½	3 17 8
do. District	Nil	Nil	18½	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅛	—	Nil
do. do. "A"	Nil	Nil	6/6	—	Nil
do. do. Income	6	6	89½xd	—	*6 14 0
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	5	—	6 0 0
Anglo-Arg. Trams, First Pref.	5½	5½	8⅞	—	7 6 8
do. 2nd Pref.	5½	5½	3	—	—
do. 5 Deb.	5	5	75	—	6 13 4
Brazil Tractions	4	4	61½	- 1	6 10 0
Bombay Electric Pref.	6	6	10½	+ ⅜	5 14 3
British Columbia Elec. Rly. Pfce.	5	5	71	+3	7 0 10
do. do. Preferred	—	Nil	53	+2	Nil
do. do. Deferred	—	Nil	51	+1	Nil
do. do. Deb.	4½	4½	68	—	6 5 0
Mexico Trams 5 per cent. Bonds	—	Nil	43	+1	Nil
do. 6 per cent. Bonds	—	Nil	35	—	Nil
Mexican Light Common	Nil	Nil	19	- 1	Nil
do. Pref.	Nil	Nil	34	—	Nil
do. 1st Bonds	Nil	Nil	43	+1	—
Manufacturing Companies.					
Babcock & Wilcox	14	15	3⅛	+	4 16 0
British Aluminium Ord.	5	7	26/-	—	5 7 8
British Insulated Ord.	15	17½	19½	+ ½	7 0 0
British Westinghouse Pref.	7½	7½	49/-	—	6 2 5
Callenders	15	20	12½	+ ½	8 0 0
do. 5 Pref.	5	5	4½	—	5 17 8
Castner-Kellner	20	—	5¼	—	5 8 3
Edison & Swan, £3 paid	Nil	—	10/6	—	Nil
do. do. fully paid	Nil	—	1⅜	—	Nil
do. do. 5 per cent. Deb.	5	5	62½	+2½	8 0 0
Electric Construction	6	7½	17/6	—	8 11 6
Gen. Elec. Pref.	6	6	10	—	6 0 0
Henley	20	25	16¾xd	+ ⅜	7 9 2
do. 4½ Pref.	4½	4½	4¼xd	+ ¼	5 6 0
India-Rubber	10	10	12¼	—	*3 3 4
Telegraph Con.	20	20	29	—	*6 4 0

* Dividends paid free of income-tax.

METAL MARKET.

Fluctuations in August.



Canadian Trade.—U.S. Consul G. Willrich, reporting on the trade of Quebec Province during 1915, says that the disturbing influences on the trade and commerce of Quebec brought on by the European war were successfully overcome by a gradual process of adjustment, and by the end of 1915 general conditions were considered fairly satisfactory. The large volume of munition orders led to the enlargement and erection of new plants, and greatly helped to restore commercial and industrial stability. Other industries and manufacturing plants also felt the impetus caused by the generous distribution of orders for war material, so that a great number were forced to run at full capacity by the end of the year. One of the principal benefits, however, was the great reduction in the number of the unemployed, leading even to a scarcity of skilled labour, which was overcome, however, by the employment of skilled mechanics brought from the United States. The return of prosperity was hastened by a realisation of greater economy on the part of all classes of the people, coupled with an increased production of food products and manufactures.

The exports of aluminium to the United States for 1915 show a substantial decrease, due to the fact that the requirements of the British Government were in excess of the available supply. The only other aluminium works in the British Empire, that of the British Aluminium Co., Ltd., in England, is controlled by the Government. Practically the entire output of the Shawinigan Falls plant was either sold directly to the War Office or supplied to American or Canadian manufacturing plants for the purposes of the British Government. Early in 1915 the Canadian Government put an embargo on aluminium shipments to countries other than British Protectorates, although shipments were permitted to a few American firms working on war contracts. There were exported to the United States from Quebec 17,000 tons more of asbestos in 1915 than in 1914, at an increased valuation of £121,626. Asbestos is the chief mineral product of this Province. The industry was unfavourably affected by the outbreak of the war, as Germany and Austria were the principal markets for the higher grades of asbestos. There has been an increased demand for this article, however, from the United States, Great Britain, France, and Italy, due in a large measure to military and naval requirements. This demand has greatly revived the industry, which has continued to improve ever since.

Profit-sharing.—Nearly 9,000 employés of the General Electric Co.'s plant in Schenectady have received their first extra payments as a result of the most successful year in the company's history. Similar distributions were made to long-service employés in other localities, so that about $550,000 was distributed among 19,000 employés. The second extra payment, to be made next February, will probably be somewhat larger in total.

NOTES ON OLD AND NEW CONVERTING PLANTS.

[Communicated.]

So far as this country is concerned, the first notable example of the use of rotary converters was on the Central London Railway, for prior to its opening in 1900 the few electric railways that existed were worked entirely with continuous current. Three-phase transmission had, it is true, been adopted on the Dublin tramways, but the sub-stations were small and insignificant compared with those which were set to work on the opening of "The Twopenny Tube." The fact that there have been few interruptions in the supply on this line shows that these early converters, like the remainder of the plant, were well designed, although the experience of the last 16 years has led to distinct improvements, and, viewed in the light of modern practice, the original Central London plant has certain imperfections. Not all the early faults of this railway's sub-stations were due to inexperience; they were due in a large measure to the want of space. The electrification of the tube railway running through the heart of London incurred many difficulties not met with when electrifying the suburban sections of main lines, such as those of the South-Western. On railways like the latter the plant is not placed in the bowels of the earth, but is erected in spacious and well-ventilated buildings which do not impose troublesome restrictions upon the electrical designers. The converters, transformers, and switchboards are very accessible, and much less dangerous than those built in the past, whilst the new methods of starting, &c., make the operation of the later sub-stations comparatively easy.

When the Central London Railway commenced working, the method of starting rotaries on the alternating-current side was, to say the least, crude. When the generating plant had been shut down, the only way of energising the line afresh was to start a rotary on the A.C. side. As the converters were not fitted with induction motors, and as there were not, in the early days, any tappings on the secondaries of the transformers, full pressure had to be applied to the slip rings. As the machine ran up to speed, taking, of course, a very large current at a very low power factor, the field switch was closed in the ordinary way, but sometimes it was closed at the wrong instant. The starting operation then had to be repeated, for the field switch was not of the throw-over type. It was soon seen that what was wanted for starting rotaries, by applying A.C. to the slip rings, was reduced pressure and a throw-over field switch, so that if a machine excited with incorrect polarity, matters could be rectified by reversing the direction of the exciting current. Hence it is now usual to fit rotaries, started in this way, with a throw-over field switch and switches or controllers for bringing different transformer tappings into use, thus allowing a low pressure to be used first, and full pressure afterwards. Many rotaries have for a long time past been started with induction motors, and, until quite recently, it has been necessary to synchronise. But the need for this has now been removed by electrically connecting the induction motor and converter. Instead of the inner ends of the stator windings terminating in a star or neutral point, they are connected to the rotary's slip rings. The result is that current passes through the induction motor into the converter, and this current pulls the rotary into step. The operator simply closes the A.C. switch on the low-voltage contacts, and transfers it to the full-pressure contacts at the proper instant.

In the direction of inventing methods for regu-

lating the voltage of rotaries, much good work has been done. Provided that a wide variation is not necessary, it has been usual, for a long time past, to insert reactances between rotaries and their transformers, or to design the latter with a fair amount of magnetic leakage. With a simple vector diagram it can readily be shown that when the current leads, as a result of increased excitation produced by increased current passing round the series windings, the pressure at the slip rings rises, whilst when the current lags, as a result of reduced excitation, the applied pressure is reduced. For many kinds of service this method of regulation answers admirably; although it is, of course, obvious that it precludes the machine from operating at unity power factor at all loads. Sometimes the transformers have been provided with tappings and a regulating switch for bringing different pressures into use, but on large machines this is impracticable, for a switch capable of changing the connections whilst the machine is running is bulky and expensive. For a wide variation, there is nothing better than a booster coupled to the rotary and electrically connected in series between the transformers and the slip rings. When the converter has a large number of poles it may be expedient to depart from the practice of directly coupling the booster to the rotary shaft. It may be more economical and convenient to use a high-speed booster, driven by a high-speed synchronous motor. But in any case it is obviously unnecessary to design the booster to deal with the full voltage variation required, for by reversing the direction of current round its field magnets, the voltage either assists or opposes that of the transformers. With this system of regulation the rotary can run at unity power factor at all loads.

If a booster be directly connected to a rotary converter it acts as a generator when adding to the transformer voltage, and as a motor when opposing it. In a simple converter—one without a booster—the armature currents at unity power factor have practically no reaction effect on the poles. But a direct connected booster produces an additional converter armature current and a reaction on the fields proportional to this current. If the booster raises the voltage, this additional armature current acts on the commutating poles and magnetises them in the same direction as the main series coils, and when the booster lowers the direct-current voltage the additional current demagnetises the poles. The effect on commutation is, in both cases, bad, for the commutating poles do not produce a field proportional to the load. To eliminate the trouble various schemes have been tested. The latest and most successful, due to the General Electric Co., of America, involves the use of a relay with direct and alternating coils and a shunt winding on the commutating poles, in addition to the ordinary series winding. When the excitation in the shunt winding is correct, the pulls of the relay coils balance one another. The pull of the A.C. coil is proportional to the main A.C., and to the voltage of the A.C. booster, whilst the pull of the D.C. coil is proportional to the current in the commutating windings, and to the D.C. voltage. When the pulls are not balanced a contact point is moved one way or the other, thereby closing a circuit which operates a motor-driven rheostat in the shunt winding circuit of the commutating poles, and the variation of excitation so produced compensates for the reaction of the booster currents.

The early 60-cycle rotary converters, as many engineers know, were very poor machines indeed. Fundamentally, the difficulty was one of commutation. At 60 cycles the limitations of peripheral speed in machines of considerable output involved the adoption of a somewhat exaggerated multipolar design, and a large commutator to permit the number of segments necessary between poles to give a conservative voltage per bar. A 60-c. synchronous converter of even a few hundred KW. capacity had a commutator running at an unpleasantly high peripheral speed, even when chances were taken with the voltage between bars. At 25 cycles the greatly reduced rotative speed made the commutator construction easier, particularly in the case of machines rated at 1,000 KW. or more. Small converters up to perhaps 100 KW. could be, and were, readily made for 50 and 60 cycles, but at higher outputs the difficulties were formidable. Later, 60-cycle rotaries were built in modest numbers and, by great designing skill, were made to work fairly satisfactorily. But the commutating difficulties were always appearing, and for a long time these rotaries were not at all popular. Far better results were obtained on fitting interpoles. It is claimed that 60-cycle rotaries are now nearly, if not quite, as good as 25-cycle machines. In the United States many 60-cycle machines are at work, but in common with this country the opinions of engineers differ, and for the higher periodicity circuits motor-generators are sometimes chosen. The La Cour cascade converter running at half-synchronous speed is undoubtedly very satisfactory on the higher periodicity circuits, and has met with much favour in this country. If the choice lies between a motor-generator and a 60-cycle rotary, the saving in favour of the latter may be considerable. Taking a specific case of two 1,500-KW. sets, Mr. L. B. Bonnett, of the General Electric Co., of America, shows in a recently published article that by using 60-cycle rotaries the gain per annum amounts to no less than £1,908. There are, of course, various considerations which govern the selection of converting plant which on the whole are well understood by central-station men.

The speeds of the latest 60-cycle motor-generator sets are approximately the same as those of 60-cycle rotary converters. The 1,000-KW., 720-volt, 60-cycle rotaries and motor generators made by the General Electric Co., of America, both run at 720 R.P.M., and the 1,000-KW., 600-volt machines at 900 R.P.M. In sizes above 1,500 KW. it is becoming quite general practice to build motor-generators with two direct-current machines and one motor, a design that permits almost twice the speed that would be permissible with a single generator. The generator of a motor-generator can be made to give from a single commutator a higher voltage than can be obtained from a rotary of standard frequency. But it has been found that, in general, the cost of a single direct-current machine for a given voltage above 2,000 is greater on account of its lower speed than that of two machines connected in series. The higher speed at which the series-connected machines work also reduces the cost of the A.C. motor.

One of the faults of rotary converters is that they do not readily lend themselves to converting D.C. into A.C. when the load is an inductive one. Before satisfactory tripping devices were invented to cut out machines in the event of racing, several rather bad accidents occurred. The trouble is attributable to the fact that lagging currents demagnetise the field magnets, and since an inverted rotary runs as a shunt-wound continuous-current motor, its speed is inversely proportional to the field flux interlinked with the armature turns. If a leading current were drawn from the machine, the field would be strengthened and the speed of the rotary would fall. To overcome the difficulty the plan adopted has been to use a separate exciter driven by an induction motor, the current for which is supplied from the slip rings of the rotary converter. The exciter has to be designed so that a slight increase in speed makes a big difference to its volts, so that the field flux of the rotary is as nearly as possible constant, irrespective of the lagging currents which the machine may be called upon to give. The exciter must, therefore, work low down on the saturation curve. In practice, however, rotaries intended

always to work in the ordinary way have, as a result of some disturbance, become inverted and raced with disastrous results. These accidents, however, occurred before the introduction of adequate protective devices, and it should not be supposed that there are serious risks at the present time. One of the worst accidents that have taken place as a result of rotaries becoming inverted occurred on the Commonwealth Electric Co.'s system at Chicago. The accident was of such a notable character that the main facts connected with it are worth recalling. Two large turbo-alternators were running on the bus-bars of the station, and from these bus-bars a number of rotary converters were fed. The rotaries in turn supplied direct current to D.C. bus-bars, and to these bars a large battery and two large continuous-current generators were connected. The first thing that happened which led up to the accident was that one of the alternator armatures burnt out. Immediately the switchboard attendant opened the main switch, but omitted to open the field switch. Had it not been for the field coils of the machine being burnt, nothing further would have happened. The field coils of the faulty machine went to earth and partially short-circuited the exciter which supplied exciting current to the burnt-out alternator and to the one still running. The exciting current of the running alternator was greatly reduced, and the rotaries, with a large source of power on the D.C. side, supplied A.C. to the alternator and motored it. The current which the generator took was, of course, a lagging one, which partially demagnetised the fields of the rotaries, and their speed increased considerably. As the alternator had to run in synchronism with the rotaries, its speed increased also, with the result that the revolving structure "burst." The accident served to show that although rotaries may not be intended to work inverted, they may under unforeseen circumstances do so, and that adequate precautions should be taken to meet such contingencies.

What engineers, especially those interested in railways, are beginning to look into is the question of employing higher voltages than those used hitherto. For the first 1,200 and 1,500-volt schemes two rotaries were connected in series, and with the exception that they were insulated more liberally than usual they were built on the same lines as ordinary 600 and 750-volt machines. On the Shildon-Newport line of the North-Eastern Railway this plan of connecting two machines in series has been adhered to, but on the Bury to Manchester lines of the Lancashire and Yorkshire Railway, and on various lines in America, currents at pressures as high as 1,500 volts are taken from single rotaries. Even in the early days of high-pressure working it was found that two rotaries in series worked well. At the beginning the main trouble was that of flashing over when short circuits occurred on the line, but this was partially remedied by supporting the brush gear from the frame of the machine instead of from the bearing pedestal. Commutating poles, however, have played a big part in the evolution of high-voltage machines, as might be expected from the fact that with their aid it is possible to increase the voltage between commutator bars as well as commutator speeds. Rotary converters for periodicities up to 35 cycles per second are now built for D.C. pressures up to 1,500 volts. In the United States a number of 1,200-volt rotary converters have been at work for a considerable time, two of the most notable installations being the 500-KW. machines built for the Portland Oregon Railway and the Michigan United Traction Co. In the latter case two machines are connected in series to give 2,400 volts. For higher periodicities, in the neighbourhood of 60 cycles per second, high-pressure rotaries are not at present made. On railways taking current from existing stations working at or about 60 cycles, such, for instance, as the Puget Sound lines of the Chicago, Milwaukee and St. Paul Railway, motor-generators are employed. The line pressure on the above lines is 3,000 volts, and each converter consists of a synchronous motor driving two 1,500-volt D.C. generators. On account of the cost and constructional difficulties associated with the field windings of 1,200- and 1,500-volt machines, it has been found convenient in some cases to energise the field windings from a directly connected exciter designed for 125 volts. This exciter, however, will not, in the absence of special precautions, drop its volts sufficiently at times of short circuits. To meet the case, a resistance normally short-circuited by a contactor is connected in the converter field circuit, and when the circuit-breaker opens as a result of a "short," this contactor also opens and resistance is interposed in the field circuit.

The converters on the Butte, Anaconda and Pacific railroad and on numerous interurban railways in Michigan, all consist of two 500-KW. motor-driven generators or rotary-converters connected in series to give 2,400 volts. This procedure is necessary when using rotaries on account of limitations of design, and when using motor-generators on account of cost. When two 1,200-volt rotaries are connected in series to give 2,400 volts, the machine on the earth side is sometimes self-excited, and the one on the other side—that is to say, the machine connected to the trolley wire—is excited from the machine that is connected to earth.

High-voltage D.C. rotaries are usually liberally rated. Some have been designed to stand 200 per cent. overload for one minute, others 200 per cent. overload for five minutes and 100 per cent. overload for half an hour. Those intended for very heavy traction service have been fitted with compensating windings in addition to commutating poles. Flashing over at the commutator has in the past been one of the main difficulties with which builders of rotaries have had to contend, and at the higher pressures these difficulties have not diminished. It has been found, as a result of careful experiment, that the design of the shunt across the commutating pole windings has an important influence on how rotaries behave on short circuits. If this shunt has only resistance, and next to no reactance, flashing at times of sudden changes of load is very liable to occur. By giving the shunt a proper amount of reactance, however, the trouble is greatly diminished, for the current then divides properly with sudden changes of load.

The practice of bridging the commutating poles with magnetic material has also given good results, and when these bridges have been provided it has in some cases been possible to work rotaries without any shunts at all. Of course, the remedies that have been applied to the troubles of the lower-voltage machines apply in a great measure to those that work at higher voltages. For instance, it has long been known that short feeders must be avoided. On many 600-volt systems where flashing over has been a great trouble, marked improvement has been made by cutting out the feeders which terminate only a short distance from the machines. Any rotary will flash over if the short circuit is sufficiently severe, and since the severity depends upon the distance at which it occurs from the source of supply it is obviously inexpedient to have feeding points in the vicinity of the machines. Although there are now, in different parts of the world, a good many H.T. D.C. systems in operation, no serious damage as a result of short circuits has been reported, but, of course, if trouble did arise the practice of altering the position of feeding points would be applicable. Reactances in circuit with the feeders would of course be advantageous, but investigation has shown that they are too bulky and expensive. A scheme viewed in a more favourable light is to

introduce in each rotary circuit a resistance which under normal conditions is short-circuited by a quick-acting mechanism, which inserts the resistance in circuit the moment a "short" occurs. Experience indicates pretty clearly that short circuits on H.T. D.C. apparatus are on the whole less destructive than those which occur on 600-volt apparatus. It is the amount of current that seems to count, and not the pressure.

Although high-pressure converters are a little more likely to flash over than those that work at lower voltages, they will not, if properly designed and protected, give appreciable trouble. All converters have as a result of great perseverance and skill been brought to a high state of perfection, and they are a credit to the electrical profession.

LIGHTING COMPANIES AND LOCAL AUTHORITIES.

[From a Legal Contributor.]

Apart from the Electric Lighting Acts, there are certain statutes "on the book" which affect the relations between electric lighting companies and local authorities. The supply of electricity having been in vogue for many years, the questions arising on these statutes have for the most part settled themselves, but, with a view to enabling our readers to avoid such disputes in the future, it may be convenient to refer to some of the material sections of these Acts and to the cases decided thereunder. First, as to the right of an electric supply company to interfere with the surface of a street or highway: By Sec. 149 of the Public Health Act, 1875, all streets are vested in the urban authority, and, by the same section, any person who, without the consent of the urban authority, wilfully displaces or takes up, or who injures the pavement, stones, materials, fences, or post of, or the trees in any such street shall be liable to a penalty not exceeding £5.

A question has arisen as to whether this section vests the soil of the highway in the local authority, so as to enable them to order a lighting company to remove wires already placed beneath the surface.

This point was considered in the case of Battersea Vestry (St. Mary) *v.* County of London and Brush Electric Lighting Co. (1899), 1 Ch. 474. In that case it appeared that land under which a company proposed to run a pipe or drain was vested in them for the purpose of their undertaking. Under a private Act a road running over this land had been transferred to and vested in a local authority. The local authority gave no consideration for the road. On the local authority applying for an injunction to restrain the company from laying a pipe or drain under or trespassing on the road, it was held that the road was vested in the local authority only for the purpose of a road; that they had no right to the subsoil, and consequently that no injunction could be granted.

Another case decided that the section does not enable a local authority to maintain an action for an injunction to restrain the erection of a telephone wire across a street.

It is now well known that a local authority may contract with a company to light streets by electricity. In making such a contract, the provisions of Sec. 174 of the Public Health Act, 1875, have to be remembered. It provides that with respect to contracts made by an urban authority under the Act, the following regulations shall be observed, namely:

1. Every contract made by an urban authority whereof the value or amount exceeds £50 shall be in writing and sealed with the common seal of such authority.

2. Every such contract shall specify the work, materials, matters or things to be furnished, had or done, the price to be paid, and the time or times within which the contract is to be performed, and shall specify some pecuniary penalty to be paid in case the terms of the contract are not duly performed.

Absence of a penalty clause renders the contract unenforceable. In the case of British Insulated Wire Co. *v.* Prescot U.D.C. (1895), 2 Q.B. 463, it was held that this enactment was obligatory, and not directory only; so that a contract which did not specify any pecuniary penalty could not be enforced against the urban authority.

Although the soil of a highway may not vest in the local authority, so as to enable that body to restrain the suspension of wires over the surface, urban authorities have considerable powers as to the regulation of overhead wires.

Thus by Sec. 13 (1) and (2) of the Public Health Acts Amendment Act, 1890, it is provided that "An urban authority may from time to time make, alter, and repeal by-laws for prevention of danger or obstruction to the public from posts, wires, tubes, or any other apparatus stretched or placed above, over, along, or across any street (whether before or after the adoption of this part of this Act) for the purpose of any telegraph, telephone, lighting, railway signalling, or other purpose."

By such by-laws provisions may be made for the inspection and examination by the urban authority of any such posts, wires, tubes, or other apparatus, and for the prohibition of any such posts, wires, tubes, or other apparatus being or continuing to be stretched or placed as aforesaid in such manner as to be dangerous or to cause obstruction to the public.

Again, by Sec. 14 (1) and (2): "If any post, wire, tube, or other apparatus so exempted as aforesaid is, during the period of such exemption in the opinion of the surveyor of the urban authority in such a state or position that immediate danger to any person is to be apprehended, he may give information to any justice, who may thereupon summon the owner or lessee thereof or other person interested therein forthwith to appear before a court of summary jurisdiction." The court may thereupon: (*a*) make an order requiring such owner, lessee or other person, or all or any of them, to remove or remedy the source of danger; or (*b*) make an order authorising the surveyor to do so at the expense of such owner, lessee or other person, or of all or any of them; or (*c*) make such other order as may appear to the court under all the circumstances of the case to be necessary and proper.

The provisions of this Act do not, however, apply to any works of any undertakers within the meaning of the Electric Lighting Acts, 1882 to 1888, to which the provisions of those Acts apply.

Another Act which is frequently discussed between companies and local authorities is that known as the Public Authorities Protection Act, 1893. To refer to its provisions at length is unnecessary; suffice it that it compels anyone who is suing a local authority to commence his action within six months of the injury; it entitles the successful local authority to solicitor and client costs, and it enables the local authority to tender amends. Finally, if the court is of opinion that the local authority has not been given a proper opportunity of tendering amends before the action was brought, the plaintiff may have to pay costs if successful.

Various cases in relation and incidental to the supply of electricity illustrate the effect of this Act. For instance, in Ambler v. Bradford Corporation (1902), 2 Ch. 585, the defendants, in providing a generating station for Bradford, acquired some land which adjoined a stream, and upon that they proceeded to erect certain sluices, the object of which was to divert the stream so as to supply condensing plant placed in the works which they erected on the adjoining land. In 1890 a heavy thunderstorm burst over the Bradford Valley, filling the Bradford Beck and causing a flood, which the plaintiffs alleged, by reason of the obstruction of the sluices, and the consequent heading back of the water, forced up the water on to the plaintiff's premises, causing damage to large quantities of goods and machinery belonging to the plaintiffs, for which they sued the Corporation, and on the trial of which judgment was given in favour of the Corporation, with costs as between party and party. It was held that the defendants, in carrying out the works under the powers conferred upon them by their provisional order, were acting in execution of a "public duty or authority" within the meaning of Sec 1. (*b*) of the Public Authorities Protection Act, 1893; that the judgment obtained by the Bradford Corporation carried costs, to be taxed as between solicitor and client; and that the appeal would be allowed, with costs as between party and party.

In another case, Chamberlain *v.* Bradford Corporation (1901), 64 J.P. 806, it appeared that a municipal corporation acting under a provisional order, hired electricity meters from a third person. The plaintiffs brought an action against them for infringement of their patent for electricity meters. Judgment having been given in favour of the Corporation, it was held that the Corporation were entitled, under Sec. 1 (*b*) of the Public Authorities Protection Act, 1893, to costs as between solicitor and client.

The protection of the Act does not, however, extend to contractors working for local authorities.

We have dealt with the general powers of local authorities over streets and roads, the contractual relations of lighting companies and local authorities, and the Public Authorities Protection Act. There remain to be considered certain provisions of Acts of Parliament relating more particularly to London.

The fact that the local authority has general control over the streets and roads in its district enables them to alter the position of pipes and wires beneath the surface as and when occasion arises. Thus Sec. 98 of the Metropolis Management Act, 1855, provides that: "The vestry may alter the position of any mains or pipes in or under such street, such alteration to be made subject to the approval of the engineer." The authority need not, apparently, replace wires in exactly the same position after they have altered the road. In Southwark and Vauxhall Water Co. *v.* Wandsworth Board of Works (1898), 2. Ch. 603, it appeared that a local authority, acting under the power conferred by the above Act, proposed to lower the surface of the streets in their district. Upon motion by a water company, whose pipes lay under the streets, to restrain the local authority from carrying out their proposed works without also lowering the pipes at least the same distance, it was held that the section imposed no duty upon the defendants to lower the plaintiffs' pipes; that they had in no way injured them, or otherwise interfered with them, and therefore the plaintiffs were not entitled to the injunc-

tion claimed. The law was thus stated by Chitty, L. J.: "I am unable to find in the section any express or implied duty cast upon the road authority, when they exercise their power of altering the level of the road, whether by raising or lowering it, to exercise at their own expense their power of altering the position of the pipes for the benefit of the company owning the pipes, much less any duty to place the pipes at a depth below the new surface corresponding with the depth at which they stood below the old surface. I think no such duty is cast upon the appellants."

Although it only concerns electric lighting companies within the Metropolis, the London Building Act contains certain provisions with which it is necessary for the electrical engineer to be familiar. Thus by Sec. 145 of this Act, it is provided that notice must be given where a building structure or work is about to be begun, two clear days before it is begun. The point of interest is what is included in the phrase "Structure or Work."

In Whitechapel Board of Works *v.* Crow (1901), 84 L.T. 595, the appellants, being a local authority within the meaning of the Electric Lighting Acts, 1882 and 1888, had, in pursuance of those Acts, obtained a provisional order confirmed by statute. Under the provisions of that order they constructed boxes in the street in connection with the supply of electric light. It was held that such boxes were buildings, structures or works within the meaning of the London Building Act, 1894, Sec. 145, and that notice under that section must be served on the district surveyor before the erection of such boxes.

This case was followed in Charing Cross & Strand Electric Supply Co. *v.* Woodthorpe (1903), 67 J. P. 286. It was there held that a street box of an electric lighting company, built of brick underneath a pavement, and large enough to hold a man, is a "building, structure, or work" within the meaning of Sec. 145 of the London Building Act, 1854.

The fact that the company's provisional order requires them to give notice to the Postmaster-General and to the street authority of their intention to construct the box, does not exclude the operation of the Building Act; and they must therefore give notice also to the district surveyor.

Finally, in the County of London Electric Supply Co. *v.* Perkins (1908), 98 L. T. 870, the company had similarly been summoned for omitting to serve a building notice under Sec. 145 of the London Building Act in respect of a street box which measured internally 27 in. in length and width and 30 in. in depth from the surface of the footway. It was argued that the case differed from Whitechapel Board of Works *v.* Crow (Supra), and Charing Cross & Strand Electric Supply Corporation *v.* Woodthorpe (Supra), for the reason that, in the first place, the structure here was much smaller than in the previous two cases, and, in the second place, notices had been served on the Postmaster-General, the Borough Council, and the London County Council in accordance with the company's order. The Court declined to distinguish the case from the other two.

FRENCH ELECTRICAL AND OTHER TRADE.

Several reports have recently been made by U.S. Consuls on the position of commercial and industrial affairs in France. Consul-General Thackara, writing home in April from Paris, said:—

"There was great activity in the electrical industries of France during 1915. The plants were kept well employed in supplying the heavy demands for electrical material of every kind for the equipment of factories. There were large orders placed for direct-current motors for operating machine tools and other machinery, and important contracts were made for the equipment of hydro-electric plants. None of the leading French railway companies contracted for the new electrification of their roads in 1915, and trade in material for electrical railways and tramways was confined almost exclusively to repair work. There was a notable increase in the manufacture of metal-filament lamps in France during 1915, and the output would have been much greater had there not been a great scarcity of glass bulbs. But little progress was made in the development of the small power, half-watt lamps for domestic lighting, their use being mostly confined to special purposes for army use. There was an increased demand, however, for half-watt lamps of higher intensity; that is, of 200, 600, 1,000, and 2,000 c.p. Prices in the electric lamp trade, which had been seriously depressed by foreign competition before the war, became much more favourable, notwithstanding the great increase in the cost of production. As a rule all the prices of electrical products have advanced considerably. As most of the output was furnished to plants working on war orders the question of prices was not as important as that of speedy deliveries.

"The prospects for the French electrical industry appear bright. After peace is restored there will be a period of intensive activity. Many of the important industrial plants, especially mining and metallurgical industries, are situated in the invaded districts, and probably have been either destroyed or badly crippled, and for the re-establishment of these plants and for the creation of new industries that are projected for manufacturing in France many products that were imported from enemy countries, a great quantity of electrical and other machinery will be required. The situation is of intense interest to American manufacturers, as they will undoubtedly be called upon to supply many of the wants of the French consumers."

Mr. W. H. Hunt, writing in the same month from the St. Etienne Consular district, as the result of interviews with competent authorities, said:—

"The commercial and industrial conditions in the district at the close of 1915 were, on the whole, better than at the same period in 1914. In some lines they were very good, notably the remarkable activity in the iron and steel mills, which has been the means of furnishing employment to thousands of men and women and thus materially increasing the purchasing power of the people.

"No statistics are obtainable relative to the amount or value of the production of iron and steel during 1915, but it may be said that from a low ebb the production has increased to such an extent that all former records have been surpassed, while values have risen steadily with sharp advances during the last half of 1915. The industries sustained various setbacks during 1914, culminating in the demoralisation arising through the workmen being mobilised at the outbreak of the war, but influences from the same source have contributed to the revival. While certain phases of the industries are obviously temporary, and the permanency of others is doubtful, it is believed that the headway gained is likely to carry the industries into a period of activity extending over several years. Every effort is being exerted to cope with the changed conditions; new mills are being constructed, while furnaces are being fired that had been abandoned for years. A considerable rise in the prices of all raw materials is reported, due in part to the domestic sources of supply being cut off by reason of the ore-producing regions being in the possession of the German forces, as well as to the unprecedented rise in freight charges. Wages likewise advanced 50 per cent., for which the increased cost of living, scarcity of labour, and high scale of wages paid by the Government factories are chiefly responsible."

In giving advice to those interested in sending American goods to the market, Mr. Hunt says:—

"The St. Etienne Consular district being inland, direct importing is limited. American goods reach this district through large wholesale houses established at Paris, which send travelling salesmen periodically through the district. . . There are many useful American-made novelties that could be successfully marketed in this district, but the large and small local retailers have no facilities nor the required capital to carry out the necessary work to create the demand. Some plan ought to be worked out that would enable local merchants to get in direct touch with American manufacturers. The attention of American manufacturers and exporters is called to the question of corresponding with French merchants in their own language, and the printing of explanatory trade literature in French so far as possible. This Consulate is ready at all times to render aid of this kind, and local merchants come to this office regularly with letters and cablegrams to be translated. Frequently they are so brief and with technical phrases that it is sometimes difficult to put them into intelligible French. Timely service of this kind during 1915 was the direct cause of promoting several shipments of American shoes and belting and sole leather valued at $30,000.

"In normal times French merchants do not care to pay for goods before they are received, and they are accustomed to and expect to receive credits varying from 30 to 90 days. The French merchants want American goods, yet business must be done in their way. American manufacturers as a rule refuse to quote prices otherwise than f.o.b. New York, or more often their home town. With such quotations it is difficult, if not impossible, for the French merchant established in an interior district like St. Etienne to figure on this basis whether he will be able to sell the desired goods at a profit or not. It is possible that this disinclination on the part of American manufacturers to quote c.i.f. prices may explain the reason why the merchants in this region handling certain kinds of American goods prefer to buy them through Paris agencies or wholesale importers."

The Grenoble district report (Consul T. D. Davis) says:—

"Numbers of responsible business men are anxious to establish permanent relations with American houses for the sale of American goods, it being the popular view that the United States will necessarily supply the greater part of the commercial and industrial needs of the country after the war. At that time there should be a good demand in this section for industrial machinery, machine parts and supplies, hardware, ... and automobiles and motor trucks. There should also be a fair demand for electric fixtures. There will be, of course, a temporary demand for American manufactures of almost every kind, and if articles of good quality are offered and the price with the freight and tariff added is not too high, a permanent trade in many lines may be established. A most important matter, however, is the attitude of the American exporter on the question of credits. There are instances where Americans have exacted of French buyers of reputed large credit that they deposit the amount of probable aggregate orders in American banks before shipment would be made. In one case a credit of 900,000 francs ($173,700) was required to be established with a designated

American bank. These terms were complied with, and a business satisfactory in all other respects has resulted; but it should occur to those who desire to establish permanent relations with French merchants of the interior provinces that these terms will be met only so long as the abnormal conditions make it absolutely necessary. Unless arrangements can be made through the establishing of better banking facilities or otherwise by which credit can be extended to reliable concerns, permitting at least 30 days, preferably 60 or even 90, for the payment for merchandise after delivery, with suitable discount for cash payments, the amount of trade that will be held in this district against competition will be negligible."

REVIEWS.

Installations Electriques de Force et Lumière. Schémas de Connexions. By Adr. Curchod. Paris: Dunod et E. Pinat. Price 7f. 50c.

A brief preface by M. P. Janet introduces us to this extremely practical little work. He remarks that its format will permit of its being placed in an inside pocket, next to the indispensable slide-rule, and this is true, though we predict confidently enough that if it were subjected to much pocket use it would soon drop to pieces. We have had occasion to remark in reviewing other French technical publications, that they are very poor examples of the book producer's art.

Briefly, there are 80 plates, consisting of diagrams of connections of all kinds of apparatus, with 45 pages of descriptive matter, and a feature which we should like to see in our own technical literature, viz., a list of the symbols used in the work, with their meaning.

Forty plates deal with continuous-current installations, from the single machine supplying a lighting network, with field rheostat, voltmeter, and amperemeter, to compound-wound machines paralleled on bus-bars to many feeders.

The next 23 plates deal with alternating-current connections, then follow five on the transformation of alternating into continuous current, and 12 on miscellaneous apparatus.

Altogether, this is a useful work for the practical man, and the mere tracing-out of the diagrams themselves forms an exercise the educational value of which is by no means to be despised. Considering the price, however, we must repeat that we do think the binding ought to be improved.

The Dynamical Theory of Gases (Second Edition). By J. H. Jeans, M.A., F.R.S. Cambridge University Press. Price 16s. net.

While the first edition of this book aimed at developing the theory of gases upon as exact a mathematical basis as possible, the present edition attempts to render as much as possible of the book intelligible to the non-mathematical reader; in order to accomplish which the author has divided it to a large extent into mathematical and physical chapters. Thus the student whose interest lies chiefly on the experimental side can get an intelligible account of the present state of the subject by reading certain chapters and regarding the more mathematical ones simply as material for reference.

The work, of course, is a very complete treatise on its subject, and the mathematics is far beyond the range of the practical man—even though the latter be very completely and scientifically trained. Nevertheless, in the more physical parts there are many matters which he can grasp, and which are of great interest in these days of atomic and electrical discovery. A very useful idea is that of substituting a two-dimensional concept for a three-dimensional one when considering the motions of molecules. The molecules are likened to billiard balls (for want of more precise knowledge), and as it is difficult to imagine in detail the movements of a large number of spheres flying about in three dimensions, the vessel in which the gas is enclosed is represented by a billiard table, the cushions of the latter taking the place of the walls of the vessel. It is surprising how many of the properties of gases can be illustrated by this imaginary apparatus.

The author devotes some space to the quantum theory, which has of late years rather revolutionised the position of the kinetic theory. He illustrates the difficulties encountered in the latter by considering the dissipation of energy of the billiard balls. For no matter how elastic the billiard balls and table may be, the motion of the balls, once started, cannot continue indefinitely. The energy dissipated by collisions is transformed into energy of internal vibrations. A gas should similarly in a short time lose the energy of translational motion of its molecules, and replace it by energy of internal vibration of these molecules and energy in the surrounding ether. It does not do so, however, and it was not until the quantum theory was introduced that anything like a satisfactory explanation could be found. This theory states that there is no true analogy between the two cases when we consider questions of internal vibrations and transfer of energy to the surrounding medium. For the motion of the billiard balls is governed by the well-known Newtonian laws, whereas the internal motions of molecules, and their transfer of energy to the ether, are now believed to be governed by an entirely different system of dynamical laws.

The author chiefly deals with the quantum theory in the last chapter, where he considers it in relation to radiation.

To the physicist—especially to the physicist who is also a mathematician—the book will be found of great value. It represents an immense amount of labour, is splendidly printed and bound, and contains some 436 large pages.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

11,836. "Electrically-operated clocks, &c." W. Alldis. August 21st.
11,884. "Electric bicycle." J. T. Shaw. August 22nd.
11,907. "Couplings for armoured or protective cables and electric conductors." V. C. H. Gibson. August 22nd.
11,919. "Magnetos." M.L. Magneto Syndicate & D. K. Morris. August 22nd
11,924. "Lacquering machines." Sterling Telephone & Electric Co. August 22nd.
11,944. "Magnetos." K. Ord-Mackenzie. August 23rd.
11,956. "Electrical stop-motions for knitting machines." H. Collins, Ltd., and W. H. C. Spencer. August 23rd.
11,961. "Mountings for electric, &c., lamps, and fittings thereof." Sir W. G. Armstrong, Whitworth & Co. and A. S. Cheetham. August 23rd.
11,968. "Electric glow lamps, enclosed arc lamps, &c." C. O. Bastian. August 23rd.
11,972. "Mine signalling keys." F. G. Bell, W. C. Davey, The Sterling Telephone & Electric Co. August 23rd.
11,982. "Spark plugs." J. J. Platt. August 23rd.
12,013. "Sparking plugs for internal-combustion engines." Baxter and Caunter & F. W. Suter. August 24th.
12,016. "Electro-magnetic switches." British Thomson-Houston Co. (General Electric Co., U.S.A.). August 24th.
12,019. "Primary electric cells." J. W. Nicholson (G. N. Antonoff). August 24th.
12,033. "Apparatus for wireless telegraphy." Marconi's Wireless Telegraph Co. & J. St. V. Pletts. August 24th.
12,043. "Electrical fuseboards or systems." W. Preston, W. Sanders & Co. and A. Crawford. August 25th.
12,044. "Electrical fuses, and parts appertaining thereto." A. Crawford, W. Preston and W. Sanders & Co. August 25th.
12,045. "Electrical fuseboards or systems." A. Crawford, W. Preston and W. Sanders & Co. August 25th.
12,063. "Electric machines." Soc. d'Electricite Nilmelior. August 25th. (France, August 27th, 1915.)
12,066. "Electric resistance elements." British Thomson-Houston Co. (General Electric Co., U.S.A.). August 25th.
12,070. "Mouthpiece for telephone transmitters, &c." O. Thokle. August 25th. (Norway, August 25th, 1915.)
12,090. "Telegraph systems, and apparatus therefor." Automatic Telephone Manufacturing Co. & S. R. Smith. August 26th.
12,099. "Dry cells." G. L. Tarver. August 26th.

PUBLISHED SPECIFICATIONS.

1915.

11,168. Manufacture of Electrical Conductor or Wire Retaining Bands and apparatus therefor. E. Fewkes. August 3rd. (Cognate application, 13,415/15.)
11,335. Electrolytic Recovery of Zinc from Ores and other Zinc-bearing Materials. U. C. Tainton. August 5th.
11,336. Electrolytic Recovery of Metals from their Solutions and apparatus therefor. U. C. Tainton. August 5th.
11,510. Dynamo-electric Machines. U.S. Light & Heat Corporation. August 9th. (August 14th, 1914.)
11,512. Electric Connections for Electrically-heated Irons and like Utensils. C. Kretz. August 9th.
11,544. Manufacture of Incandescent Electric Lamps. British Thomson-Houston Co. (General Electric Co., U.S.A.). August 10th.
11,566. Explosion Engines coupled to Dynamo-electric Machines. Soc. Anon. des Etablissements L. Bleriot. August 10th. (September 16th, 1914.)
11,568. Electrical Transformers. A. Schaanning & G. Harlow. August 10th.
11,715. Jewels for Measuring Instruments and the like, and Method of Manufacturing the same. British Thomson-Houston Co. (General Electric Co., U.S.A.). August 13th.
11,790. Short-circuiting and Brush lifting Gear for Alternating-current Motors. Lancashire Dynamo & Motor Co., H. B. Whitmore & R. J. Roberts. August 16th.
13,391. Ignition Systems for Internal-combustion Engines. H. Randolph. September 20th. (December 24th, 1914.)
13,901. Fittings for Electric Incandescent Candle Lamps. C. H. Burt and Huntalite, Ltd, September 30th.
14,214. Electrical Measuring Instruments. C. E. Foster. October 7th.
14,819. Internal-combustion Engines having Electrical Accessories. J. B. Fergusson. October 20th.
14,995. Contact-making and Breaking Devices of Magneto-electric Machines for Ignition in Internal-combustion Engines. M. S. Conner. October 23rd.
16,185. Electric Insulators. A. R. Muller. November 17th. (Patent of addition, 27,738/12.)
16,540. Electric Batteries. E. C. R. Marks (Interstate Electric Novelty Co., U.S.A.). November 23rd.
17,921. Rotary Interrupter for Electric Ignition Devices. Robert Bosch (firm of). December 22nd. (February 18th, 1915.)

1916.

5,398. Electric Insulating Compositions. E. Soberg & J. Anderson. April 12th. (101,067.)
5,680. Ignition Controllers for Internal-combustion Engines. W. O. Kennington. April 18th. (101,070.)